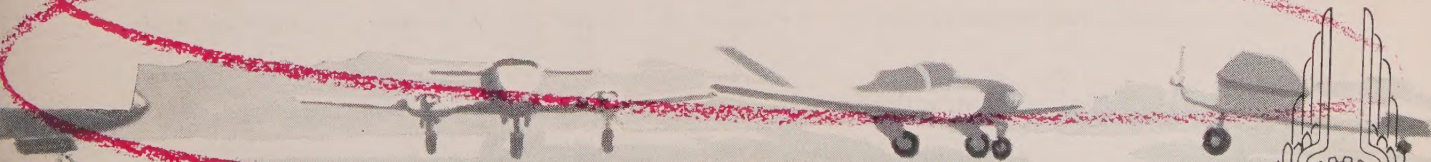


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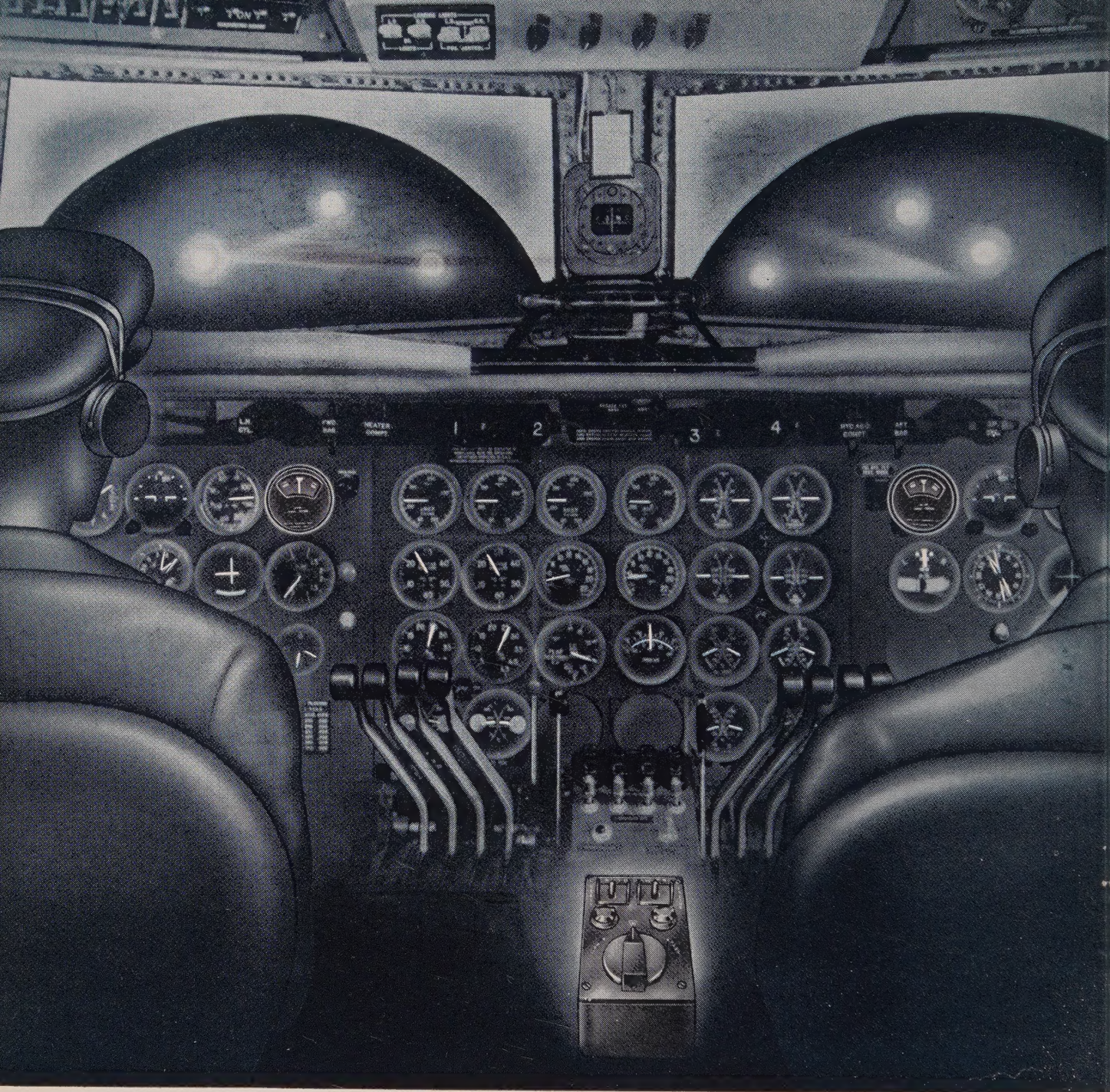
NOVEMBER 1956

F O R B U S I N E S S



National Business Aircraft Association Official Publication





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Skyways FOR BUSINESS

NOVEMBER, 1956

The official publication of the National Business Aircraft Association

COVER by Willis E. Bishop

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EDITOR & PUBLISHER

LOIS HENRY

DIRECTOR OF PUBLIC RELATIONS

Carl E. Spitzer

EDITORIAL ASSISTANT

George Watts

CONTRIBUTING EDITORS

Karl Hess—Fuels & Oils

Herbert O. Fisher—Flight Evaluations

BUSINESS & PRODUCTION

MANAGER

Stanley M. Cook

READER SERVICE MGR.

CIRCULATION MGR.

A. L. Verschoor

ADVERTISING MANAGER

Lee Clifton

ADVERTISING OFFICE, 122 E. 42nd St., New York 17, N.Y. Tel. MU 2-9138

MIDWEST—C. T. Engdall, 154 East Erie St., Chicago 11, Ill.
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Now Hear This

PERSONNEL

Herbert K. Hyde was appointed assistant to Chairman James R. Durfee, CAB.

Admiral John H. Cassidy, USN (Ret) has been elected Executive Vice President of Flight Safety Foundation.

William B. Gurney, former Assistant Chief Engineer for Solar Aircraft Co., has been named Manager of West Coast Engineering and Sales for Chandler Evans Div. of P&W.

Robert E. Wolin has been made District Manager of the Wichita-southwest commercial sales activities of Learcal Div.

John F. Burrridge has been named an Assistant Sales Manager of Hamilton Standard Div. of United Aircraft. **Alfred B. Thatcher** was promoted to Mr. Burrridge's former post as Dayton Representative of United Aircraft Service Corp.; **Morgan Jones** replaces Mr. Thatcher as Chief Sales Engineer, propellers.

Edwin D. Maxfield has been named to the newly created post of Commercial Division Manager of the Aviation Dept. of Shell Oil.

W. W. Gilmore has been elected a Vice-President of Minneapolis-Honeywell Regulator. He will continue in his present position as President of the Microswitch Div.

Ty B. Lynam has been appointed Manager of Inspection and Quality Control of Aeroproducts Div. of Allison.

Brian Sparks has been made General Manager of Clary Corp.'s Aircraft Div., and will continue in his present post as Chief Engineer.

Albert W. Gruer, Jr., has been named Director of Marketing Research of Cessna Aircraft Co. **M. F. Mellinger** has been appointed Cessna's export manager.

Dave Peterson, Chief Pilot for Sinclair Refining, has taken an extended leave of absence. **Joseph L. Lacey** will replace Mr. Peterson. **K. F. Horton** became Acting Pilot Supervisor, replacing Mr. Lacey in the New York area. **H. L. Wells** is now N.Y. pilot; **A. F. Minich** is new Pilot Supervisor in the Mid-Continent area.

AERO CALENDAR

Oct. 22-26—National Safety Congress, Chicago. Aeronautics conferences Oct. 22 & 23.

Oct. 23-25—NBAA 9th Annual Forum; Hotels McAllister and Columbus, Miami.

Complete program information for the NBAA 9th Annual Forum will be found on page 39 of this issue.

Oct. 25-26—Aircraft Electrical Society, annual equipment display; Pan Pacific Auditorium, Los Angeles.

Oct. 29-30—3rd annual East Coast Conference on Aeronautical and Navigational Electronics, sponsored by IRE; 5th Reg. Armory, Baltimore.

Nov. 1-3—National Aviation Trades Assn., 17th Annual Convention; Chase and Park Plaza, St. Louis.

Nov. 8-9—National fuels and lubricants meeting, SAE; Hotel Mayo, Tulsa.

Nov. 14-15—Aircraft Industries Assoc., export conference; Miami Beach.

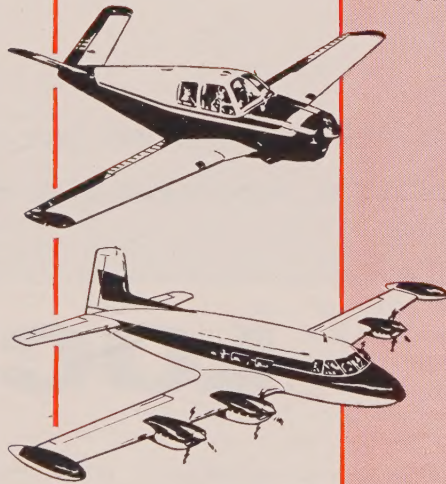
Nov. 25-27—Aircraft Dealers & Mfrs. Assn., 28th meeting; Drake Hotel, Chicago.



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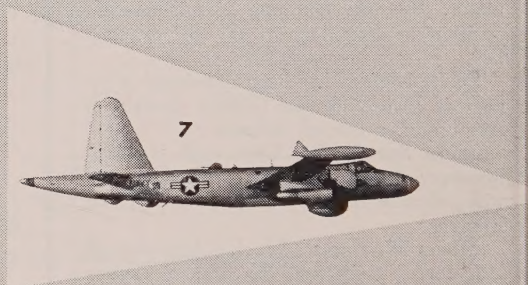
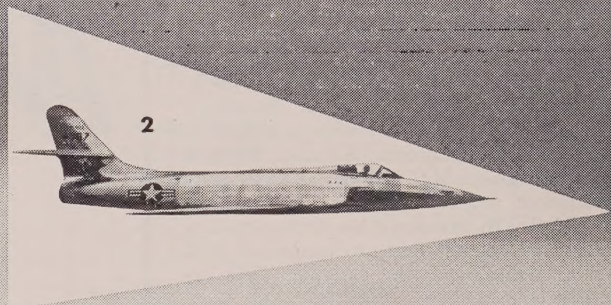
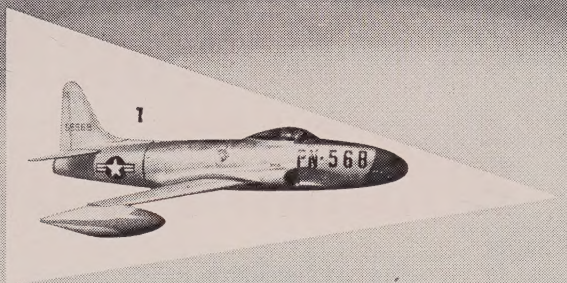
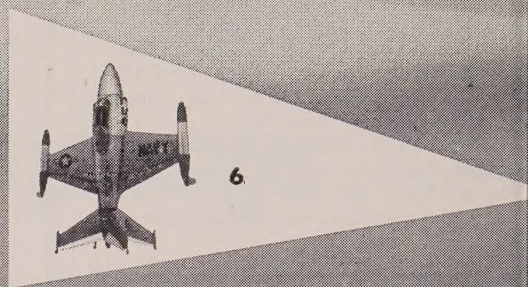
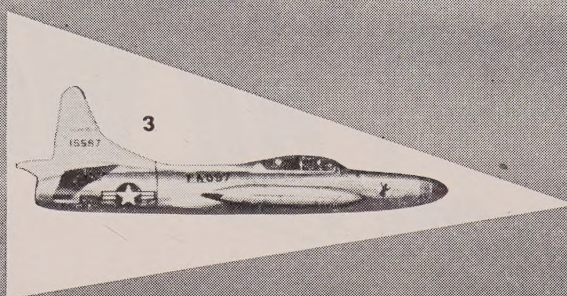


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Sleek aerodynamic beauty, time-tested structural stamina, unique high-performance capabilities and exceptional economy of operation and maintenance are but a few of the LOCKHEED ELECTRA's points of superiority. Its mighty Allison propjet engines, combining jet thrust with proven propeller dependability, enable it to whisk passengers into and out of existing air terminals which now handle nearly 98% of total U. S. air passenger traffic.

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Editorial

NBAA AND VOR/DME-TACAN

Immediately following ACC's VORTAC decision on August 30, some of the aviation press stated that NBAA had *reversed* its long and consistent stand, and had *abandoned* civil DME in favor of military TACAN. There was even an inference that such alleged reversal on the part of NBAA was a factor in the final ACC decision in favor of TACAN.

No inference or statement could have been further from the truth.

NBAA's opposition to the adoption of TACAN as a part of the Civil Airways System is well known to, and endorsed by, its members. NBAA did not believe that the millions of dollars of taxpayers' money already invested in civil DME should be thrown in the ash can; NBAA had never seen evidence that military TACAN could do a better job than DME; it did not believe that airborne safety could be served by replacing a proven system with an experimental one; it did not believe it was in the public interest to spend hundreds of millions of dollars of public funds to replace a system already bought and paid for.

NBAA's position was sound, patriotic and vigorously voiced; there was never a doubt in anyone's mind as to where it stood.

Be that as it may—ACC decided to follow the military.

The next morning *following* the final ACC decision, NBAA wired Undersecretary Rothschild and pledged its support of the newly adopted VORTAC system. Our government had made a decision and, as all good Americans should, NBAA gracefully accepted the decision; it urged full speed ahead in implementing the new system.

Such action is not *reversing* a position; such action is not *abandoning* a conviction.

Such action certainly gives no assurance that NBAA will not again oppose any attempt of the military to take over and to control the civil airways. It is hoped that this statement closes the VOR/DME-TACAN controversy.

NBAA AND SKYWAYS LOOK FORWARD WITH CONFIDENCE

Our confidence in the future of the airplane in business is based on our phenomenal growth and outstanding achievements which serve as a shining example to the entire aircraft industry. Only the most negative and skeptical would challenge the future of business flying. The remarkable faith in aviation, creative ability in manufacturing, positive thinking in solving problems, and the courage and integrity demonstrated by hundreds of firms and thousands of pilots, mechanics, executive aircraft owners, dealers, distributors, fixed base operators, airframe, engine and component manufacturing personnel and countless other contributing individuals, is responsible for the growth and maintenance of business flying as we know it today—and as we envision it tomorrow.

On the Ninth Anniversary of NBAA, it is certainly more important to look forward than to reminisce. We are no longer crusading for self-justification. Statistics over the years have effectively conveyed this message for us. In these days of decentralization, scattered markets and tough competition, the airplane is making a vital contribution to the economy, convenience and overall effectiveness of conducting business, seven days a week.

A company owned aircraft is not a luxury or a toy. Rather, to an army of organizations, the airplane is a business necessity.

There is no growth limit in sight for the airplane in business. Modern executives have learned the primary advantages of company owned airplanes. That is, "More time to sell—to produce—to plan"; for reliable figures tell us that modern businessmen spend ill-proportioned hours in travel. The businessman who has been too busy to read statistics should carefully evaluate the advantage and economy of a working, productive, company owned aircraft. There is a tremendous difference between controlling the schedule of your airplane or having the airplane schedule control you. This is but one example, of course, but we thought it worthy of single mention, because all companies share at least one major problem: how to place key employees in the right place at the right time!

NBAA and SKYWAYS are hand in hand to serve business aircraft owners, their employees, their suppliers, and we look forward to the future with confidence.

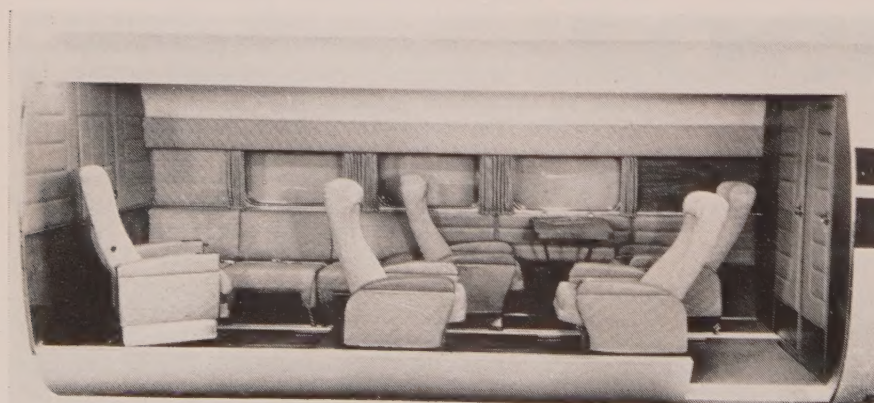
A Salute to the EXECUTIVE 620



HENRY W. BOGGESS, NBAA President and Aviation Director of Sinclair Refining Co., congratulates **Dwane L. Wallace**, President of Cessna Aircraft, on the 620 Executive Transport, characterized by Mr. Boggess as an outstanding example of free enterprise at work.



CESSNA has announced that production of the 620 will begin early in 1958. The price will be approximately \$375,000 with standard equipment. The 620's four Continental engines have been rerated to 350 hp at sea level; top speed is increased to 282 mph.



CUSTOM INTERIOR of the Executive 620. Five sleeper-type seats and a folding table are standard equipment. Customers may make additions to the standard furnishings, or substitute a completely individual interior from a wide choice of optional interior furniture.

Henry W. Boggess, National Business Aircraft Assn. Pres., says of the manufacturers of the 620:

"Without government subsidy, without advance orders or prepayment plans of any kind, Cessna . . . surveyed the market, determined that American businessmen needed a new airplane of certain size and capabilities. It created and built that airplane in record time, and the product is a joy to see.

"When an American businessman—especially in the aviation industry—has the vision, the faith and the courage to do a much-needed job, such as Dwane Wallace has done in producing the 620 without the usual monetary guarantees, our hat is off to him! He has served well and deserves to prosper—which we will bet he does!"

Production plans, specifications, and price for the new Cessna 620 Executive transport were announced at a special press conference by Frank Martin, Cessna marketing manager.

Outstanding improvements are reported for the latest 620. The Continental engines have been rerated to 350 hp at sea level; the maximum continuous rate is 310 hp. As a result, maximum speed at 15,000 feet has increased from 269 mph to 282 mph. Present maximum cruising speed (2600 rpm at 12,500 feet) is 260 mph.

Maximum range at 15,000 feet, utilizing optimum power, is 1700 miles. The four-engine CAR operational ceiling is 25,000 feet; three-engine service ceiling, at 14,500 pounds, is 20,000 feet.

Sea level take off, at V_1 , 15,000 pounds, over a 50-foot obstacle, is 3750 feet; landing with a sea-level gross weight of 14,285 pounds, over a 50-foot obstacle, is 3050 feet. Maximum rate of climb at sea level, at 15,000 pounds, is 1150 feet per minute. At 13,000 pounds, the rate of climb is 1520 feet per minute.

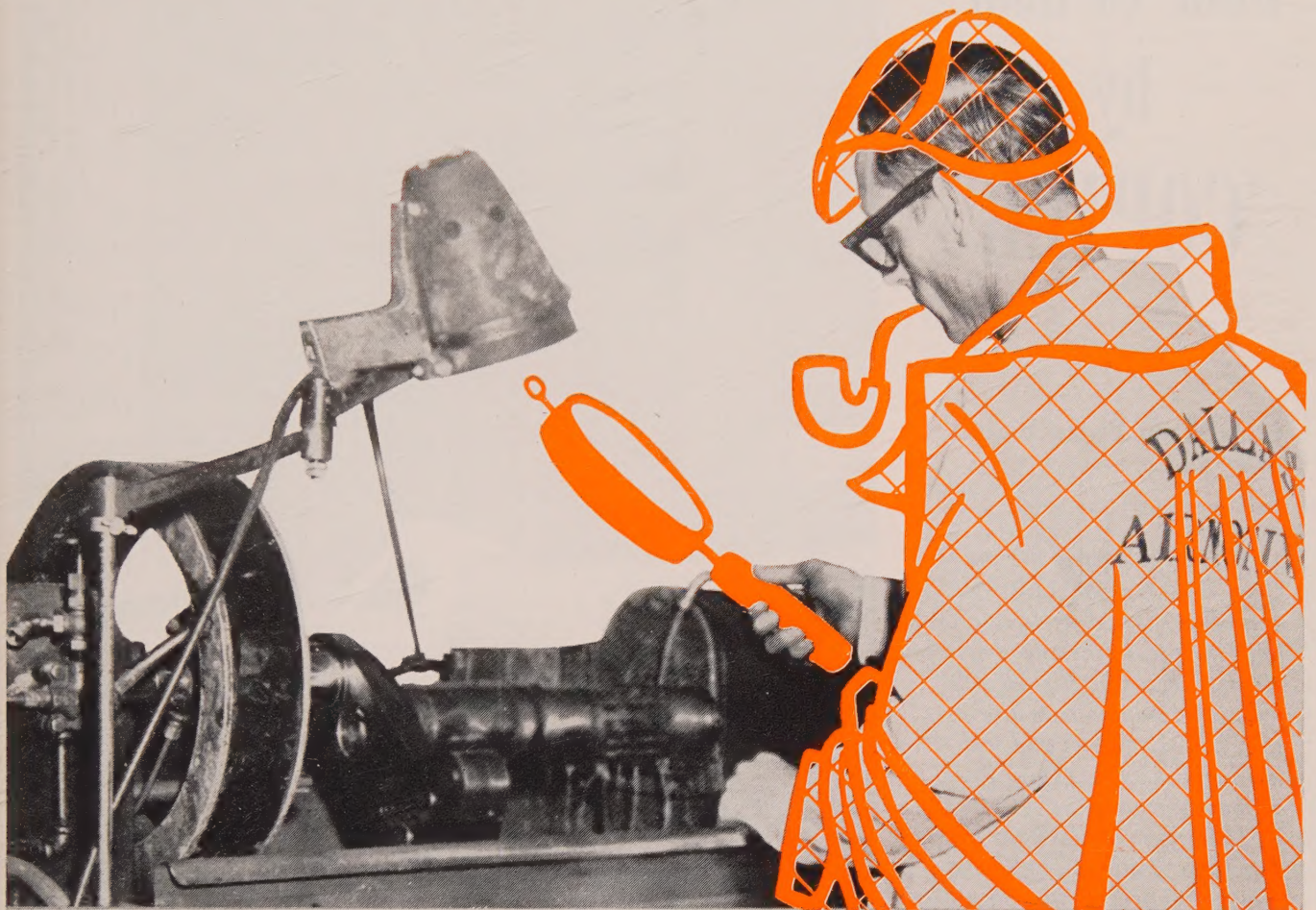
Take-off gross weight of the 620 is 15,000 pounds; landing gross weight is 14,285 pounds; the estimated empty weight is 10,000 pounds.

A variety of colors and combinations of exterior paint is standard. If the company colors are preferred to Cessna's standard combinations, Cessna designers will plan the arrangement to coordinate the color with the overall design of the plane itself.

The 620 is designed for the optional incorporation of these features: reversible propellers, power steering, non-skid brakes, wing-de-icers.

Provision is made for the installation of the Collins Integrated Flight System which includes approach horizon, approach indicator, steering computer, vertical gyro, and such supporting equipment as radar transponder, flux valve compass, autopilot, dual navigation equipment, 180-channel transmitter, 90-channel standby transmitter, dual glide path and marker beacon and dual radio compass. Passenger oxygen is optional, standard for the crew.

Detective For Defectives



Even Sherlock Holmes, with all of his scientific knowledge and equipment, could not equal the Inspection Department of Dallas Airmotive when it comes to finding evidence of defects in engine parts. Carefully and painstakingly, Dallas Airmotive's Inspection Department checks each

engine part as it comes through the shop. Those which are not absolutely safe are replaced with new parts while those which need reworking are sent to that division of Dallas Airmotive. When your engine is sent to Dallas Airmotive, it means safety and security to your flight hours.



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Door-to-door by 'COPTER

By

G. Jackson Butterbaugh

The helicopter is the only type of aircraft that can actually fly door-to-door, and business has not been slow to realize this advantage. Helicopter transportation for executives and technicians saves time and money.

This story tells how the business helicopter serves several representative modern industries.

More and more businessmen are finding the company-owned helicopter the answer to their need for quick, dependable transportation.

Commercial helicopter sales figures for the first eight months of 1956 have already exceeded last year's total commercial sales, which were some 30 per cent above those for the previous year.

With four months left to 1956, Bell Aircraft Corporation anticipates a 50 per cent increase in commercial business this year, making the company's fifth straight record-breaking sales year. Commercial Sales Manager J. C. Weadock reported that 29.6 per cent of the business goes to new customers, purchasing their first machine. The remainder go to established customers who, finding their helicopters profitable, come back for more machines.

An unheard of total of 32 per cent of helicopter sales were made to private companies and agencies, many of which previously leased the services of Bell helicopters from commercial charter operations. These companies dis-

covered that the use of the helicopter enables top executives of the firm to give their personal attention to almost all company operations, including those some distance from the home office.

Helicopter transportation for executive and skilled personnel saves time and money in two ways; shuttling between two or more plants within a 200-mile radius of the main offices; and operating on a tight time schedule meeting and delivering executives at outlying airports, eliminating the time consuming ground methods of transportation.

An excellent example of the dividends a company-owned helicopter can pay in this field is the case of Radio Materials Corporation of Chicago. Demand for RMC electronic parts and ceramic capacitors necessitated the

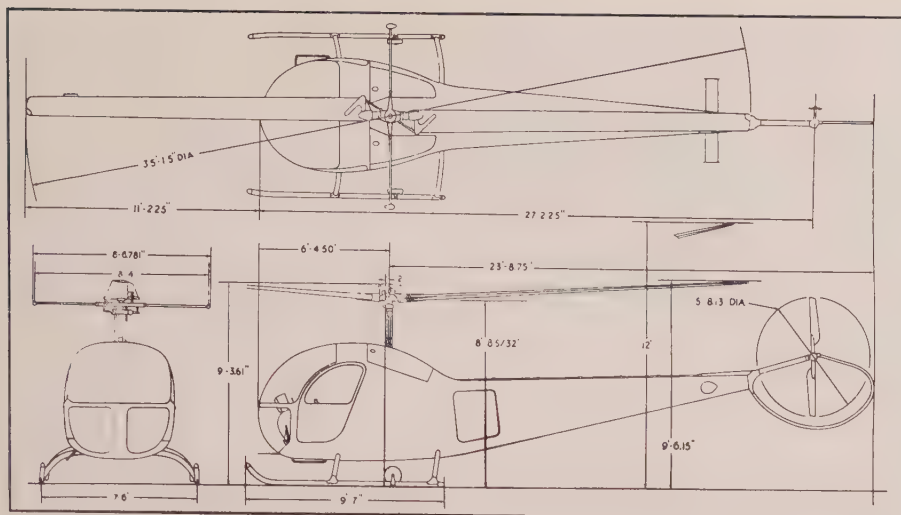
addition of a manufacturing facility at Attica, Ind. some 130 air miles away from the main plant in the northwest section of Chicago.

As the Indiana facility commenced operations, company executives found it necessary to be at the plant regularly. The company's two airplanes helped out somewhat, but the ironical situation existed whereby the executives were spending more time traveling between the airport and the plant at either end of the trip (one hour each end) than required to fly the 130 miles between the towns in which the plants were located (40 minutes).

Investigating the possibilities of the helicopter, the only method of transportation that makes door-to-door travel possible, showed that although the helicopter was slower than the fixed



LANDINGS IN CONFINED AREAS are easily accomplished by this Bell 47H Bellairus. This photograph shows the 47H landing on the roof of the Statler Hilton Hotel, in Dallas. The hotel's roof-top heliport is a short, pleasant hop from the airport.



wing aircraft (90 minutes to 40 minutes), the three-place Model 47H Bell helicopter still saved nearly two hours by completely eliminating the automobile trip at either end of the airplane flight.

Translated into executive working hours, Chairman of the Board Joseph Riley of RMC computed that the helicopter, carrying between two to three executives at a time, saves his company more than 1,000 hours annually.

Other companies taking advantage of helicopter transportation with the purchase of Bell helicopters are: Arthur V. Davis, Alcoa board chairman; Suburban Propane Gas of New Jersey; New York Trap Rock of New York; Arthur Godfrey; Magnolia Petroleum; Anaconda in New Mexico; Colorado Interstate Gas Corporation; Roger Sherman Transfer of Connecticut; Murray Petroleum of Texas; Fruehauf Trailer; Frederick Mathaei, American Metal board chairman; C. G. Glasscock Drilling of Texas; Douglas Aircraft; Morrison-Knudsen of Canada; W. T. Waggoner Estate of Texas; Midwood Signature Homes of California; Litton Electronics; United Manufacturing; Smith-Pace Pipeline; and Uranium Corporation of British Columbia.

Corporations of this caliber are not interested in novelties and gadgets. They have found the helicopter to be an important addition to their businesses. Add these to the hundreds of

big-name companies who lease the services of helicopters from the 70-odd commercial helicopter charter services scattered throughout the United States and Canada and the acceptance of the helicopter in business, finance and industry is obvious.

The commercial leasing services varying from one-man, one-machine operations to far flung organizations such as Okanagan Helicopters which keeps more than 30 helicopters busy and consistently awards five percent dividends on both A and B stock. Regardless of their size, these operators are in the commercial helicopter service business for a profit, as are the companies who operate their own machines. The increasing number of helicopter users adds weight to the statement that helicopters are profit-making machines.

Larry Bell, chairman of the board of Bell Aircraft Corporation and one of the first to envision the helicopter's commercial potential, puts it this way: "The helicopter is like a steam shovel, if you need one it's the only machine capable of performing a given task efficiently and economically. But if you don't need one, it's about as useful as a snow shovel in the Sahara."

The era of a helicopter in every garage is years away and, simply put, will not come until you can buy maintenance at the corner gas station. Manufacturers look at the helicopter as a special tool which, like the steam shovel, is often the only piece of ma-

chinery capable of doing certain work.

With corporate commercial sales on the upswing, more and more companies are discovering uses for the helicopter. As industry decentralizes and suburbanizes, and ground transportation continues to tie itself up with bigger and better knots, the aerial highway becomes more and more important to the harried executive. Because it can land and take off from an area only slightly larger than its own proportions, the helicopter is coming into its own.

Bell officials predict that the ceiling is unlimited for commercial helicopters and are backing their decision by ordering a 100 per cent increase in commercial helicopter production for 1957. Introduction of a new four-place, extremely versatile helicopter, the 260 hp Bell Model 47J, and the continuation of its three popular predecessors (three-place, 200 hp Model 47G; three-place, 260 hp Model 47G-2; and streamlined, three-place, 200 hp Model 47H), Bell Aircraft offers the potential business user a complete line of helicopters, capable of handling a wide variety of assignments.

Bell, which has sold more commercial helicopters than all other makes and models combined while more than holding its own in the military helicopter market, expects 1955's \$10 million commercial gross sales figure to be buried by nearly twice the volume anticipated next year, 1957.

And with a proven stable of development aircraft, including a speedy gas turbine, eight-place helicopter in construction for the Army and a tri-turbine transport design which could be developed in less than three years and carry 25 passengers at an estimated 10 cents per seat mile cost, tomorrow's intra-city helicopter bus is rapidly approaching reality.

The Bell XV-3 tilting-rotor design convertiplane, which combines the vertical take off and landing abilities of the helicopter with the faster speed and cruise economies of the airplane by dropping its rotors forward into standard propeller position, offers an efficient aircraft able to compete with the bus and railroad for the 28,000,000 annual passenger medium-haul market of the future.



TRAVEL TIME to and from airport and plants is minimized by Bell 47H, shown above at the Buffalo, N. Y. airport. Having just landed, two executives are within minutes of their business.



BELL Aircraft Corp.'s model 47H-1 three-place business helicopter was designed in answer to a demand for an attractive, practical executive helicopter transport.

Emergency—NOW WHAT?

A SKYWAYS Exclusive on the "Flight Translator"

During the past ten years, SKYWAYS has witnessed remarkable progress in business aviation—growth in numbers, and a progression toward better methods and procedures. One of the most outstanding developments in the field of business aviation safety is the Flight Translator, a training and proficiency device for the business pilot.

As a matter of pilot interest, SKYWAYS has arranged an interview on the "Flight Translator." For this we have turned to the man who has been closest to the subject of simulator training for business pilots—Mike Glerum, Chief Flight Translator Instructor for Flight Safety, Inc. Mike retired last year from American Airlines for reasons of health, having flown the line for 17 years on equipment ranging from the DC-2 to the DC-7. We believe he is perhaps more qualified than anyone else to comment on business pilot reaction to this device.

Skyways: Mike, as a starter, if we simply gave you the floor on this subject, what would first come to your mind?

Mike: "Unquestionably, the difference between a conventional Link Trainer and the Flight Translator. We still have people who come in here and don't know what it is. I suspect they are looking for something with a hood on it."

Skyways: How would you best describe it?

Mike: "Well, no description is quite as good as actually seeing it in action; however, I would say that the outstanding feature is that it flies—not that it really leaves the ground, but that it duplicates aircraft behavior and the surrounding elements so closely that, from a pilot standpoint, he might as well be doing the real thing. Beyond this, I would describe it as a 'walk in' trainer, accommodating two pilots with the same equipment they have in their own aircraft."

Skyways: What do you mean by the same equipment? You can't possibly have *exactly* what the pilot has, can you?

Mike: "That depends on how closely you wish to pin it down—no two executive aircraft are exactly the same. The Translator does resemble a Convair inside; however, it should be pointed out that its purpose is not equipment training, but procedures training. By that I mean that we are primarily concerned with headwork—knowing what to do

next in an emergency. Most of the pilots have made very little comment on these minor equipment differences. Practically speaking, we do have all the controls, gauges, and switches for both engines, all of which work just as they do in the airplane."

Skyways: You mean the engines get hot—show oil pressure?

Mike: "Not only that, but if the pilot does not operate them correctly he'll soon have an engine failure—complete with control pressure, sound, and instrument indications—same thing as on a real airplane."

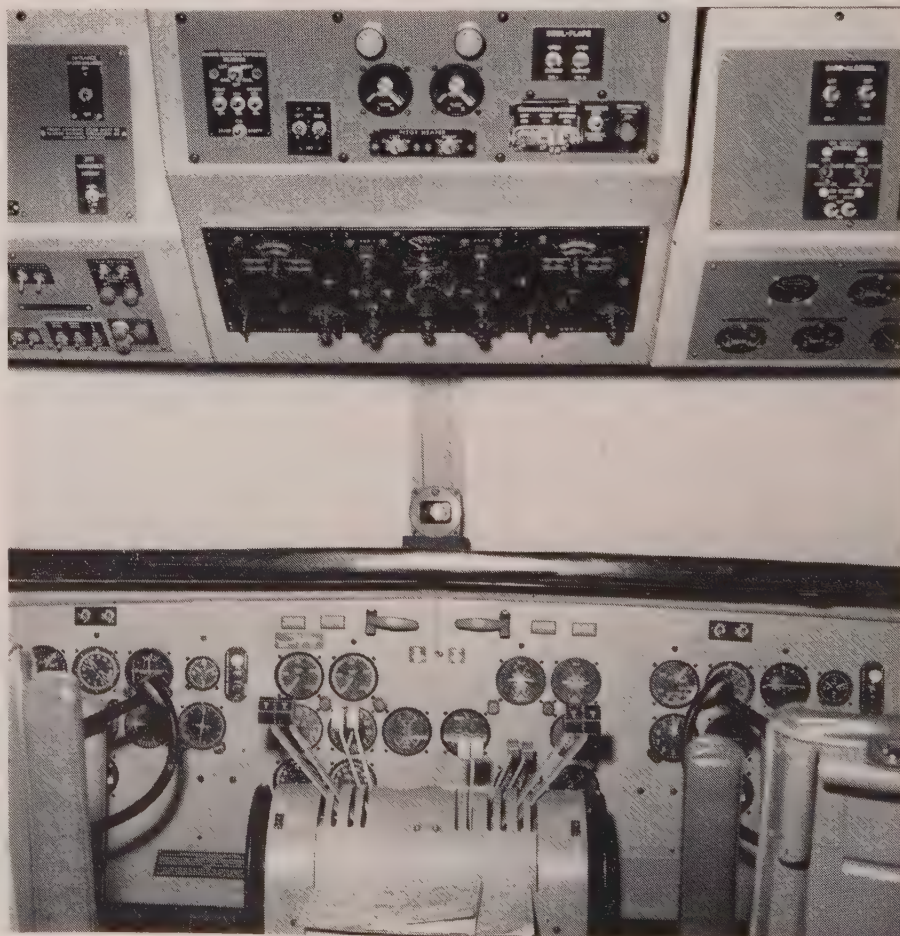
Skyways: Do you have any way of compensating for gross weight?

Mike: "Yes, but we prefer to train the

pilots under full gross conditions which is practically impossible in an airplane. Our biggest changes occur in instrumentation—switching the Collins Integrated Flight System, for example, to a Bendix omni-mag to match the pilot's own equipment."

Skyways: Mike, without going into too much detail—briefly, what is flying the Translator like?

Mike: "It'll fool you. We've had several pilots remark that they'd swear they were in the stack 7000 feet high. The noise level of the engines, control pressures, static, frosted windshield, and ATC conversation in the background all contribute to the sensation of actual flight."



THE COCKPIT of the Flight Translator is an accurate reproduction of the cockpit of a standard twin-engine business airplane. All the instruments give realistic readings of a variety of emergency situations which can be created from the control panel

Skyways: How do the pilots react on their initial flight?

Mike: "Not all alike, of course. We've had several who apparently thought that I was out to mix them up by creating so many emergencies that no one could handle them—some sort of screening program, I suppose."

Skyways: That's not exactly what I meant, but while you're on this subject, precisely what do you do?

Mike: "Well, I'm definitely not out to show anybody up—especially someone who is not familiar with the Translator—that's like pulling the rug out from under a man on his first flight in an unfamiliar airplane. I'm here to help him in any way I can. We usually start out slowly—getting the pilots familiar with the equipment—airwork—holding procedures—then gradually work emergencies in with the weather flying, and finally wind up by making things as tough as we can."

Skyways: You mean tougher than actual?

Mike: "Very definitely—not bizarre situations—not in general, tougher situations than the pilot will probably ever face in actual practice. If I can find one thing he does not know—one emergency that he cannot handle, I feel that I may have saved an airplane if I can correct it."

Skyways: Do you feel this approach is the best, or that it's justified by reality?

Mike: "My very strong personal belief is that it is. A pilot has a ceiling, so to speak, on what he can do. If he is working close to that ceiling he lacks confidence. Raise that ceiling in training by 'overloading' him, and you not only increase what he can do, but place him 'on top' of his emergency with a sure grasp of what he is to do next. Several of the airlines subscribe to this same theory—I suppose it's an 'old saw' by now, but still true."

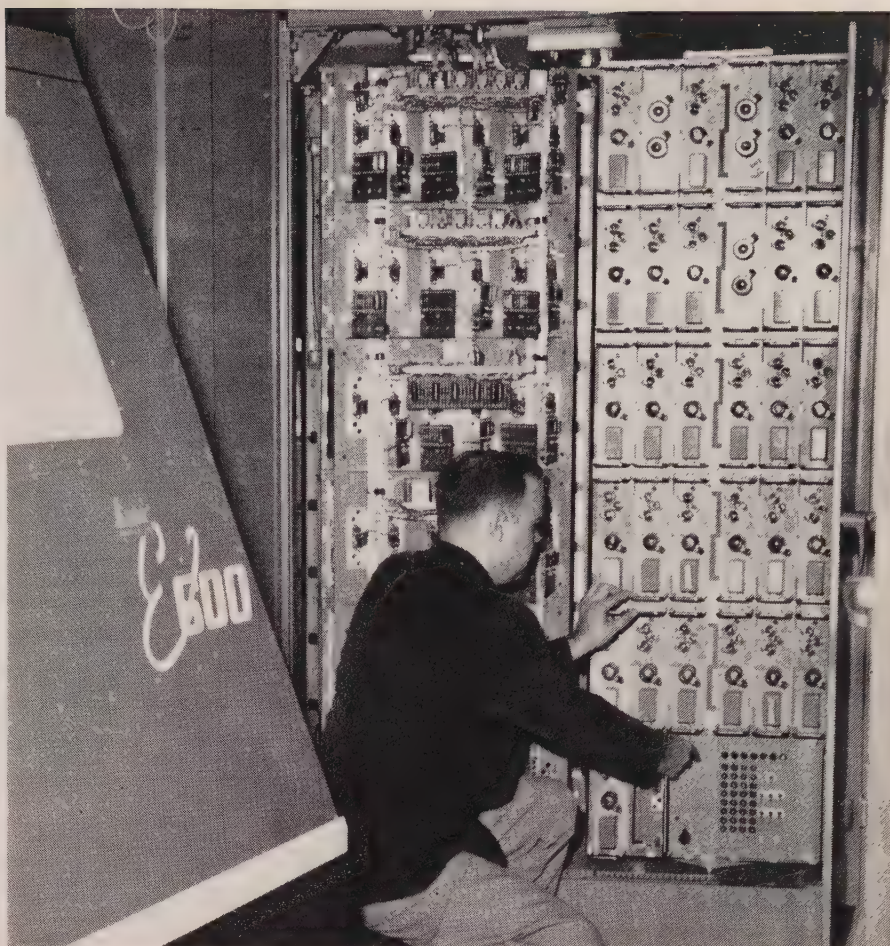
Skyways: Can't this be done in an airplane? Aren't you simply substituting the Translator for the airplane?

Mike: "Yes and no. I know the flight instructors use the same approach—that is, trying to raise the performance ceiling—but there are certain things that need to be done which you wouldn't dare do in an airplane."

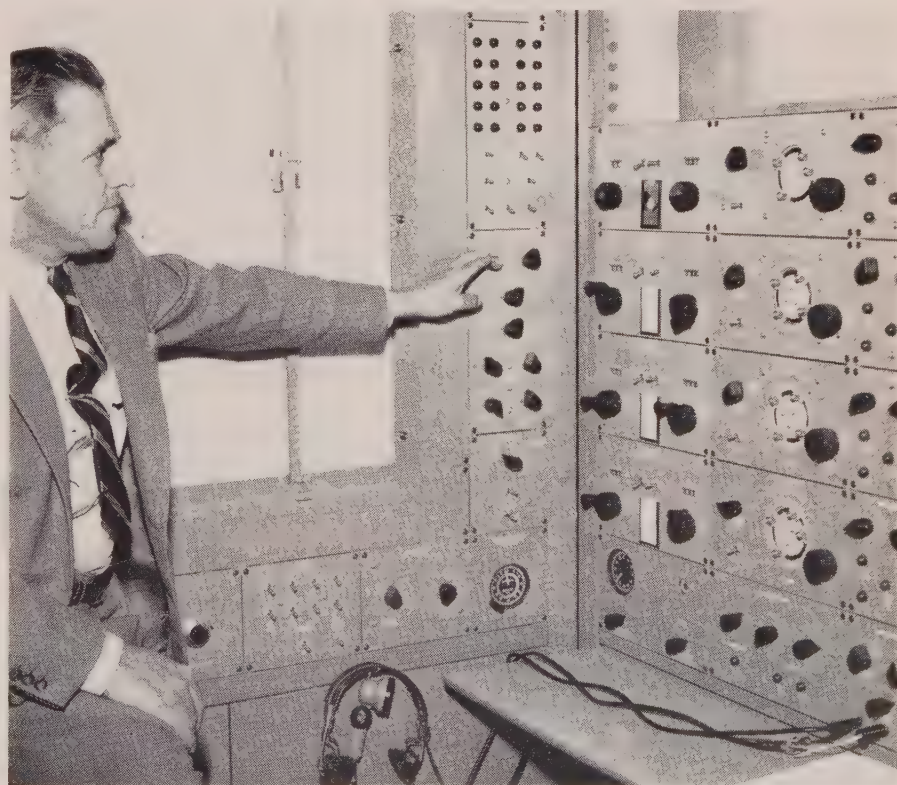
Skyways: Such as?

Mike: "Well, no one is going to sand-bag a DC-3 or a Lodestar to full gross and then pull an engine between V_1 and V_2 with the hood up—it'd be a hair raising experience, and even then you wouldn't have the realism we have here. Then there's the matter of wear and tear on the engine—it's simply not practical to run an engine at continuous high power to practice these things repeatedly—and it needs to be done. Or take the case of a runaway prop or an engine fire—the best the flight instructor can do is tell the pilot he has this type of emergency. In the Translator the prop winds up to a high pitched scream, and if the pilot doesn't haul back on the airspeed I simply hold down the feathering "override" switch

(Continued on page 53)

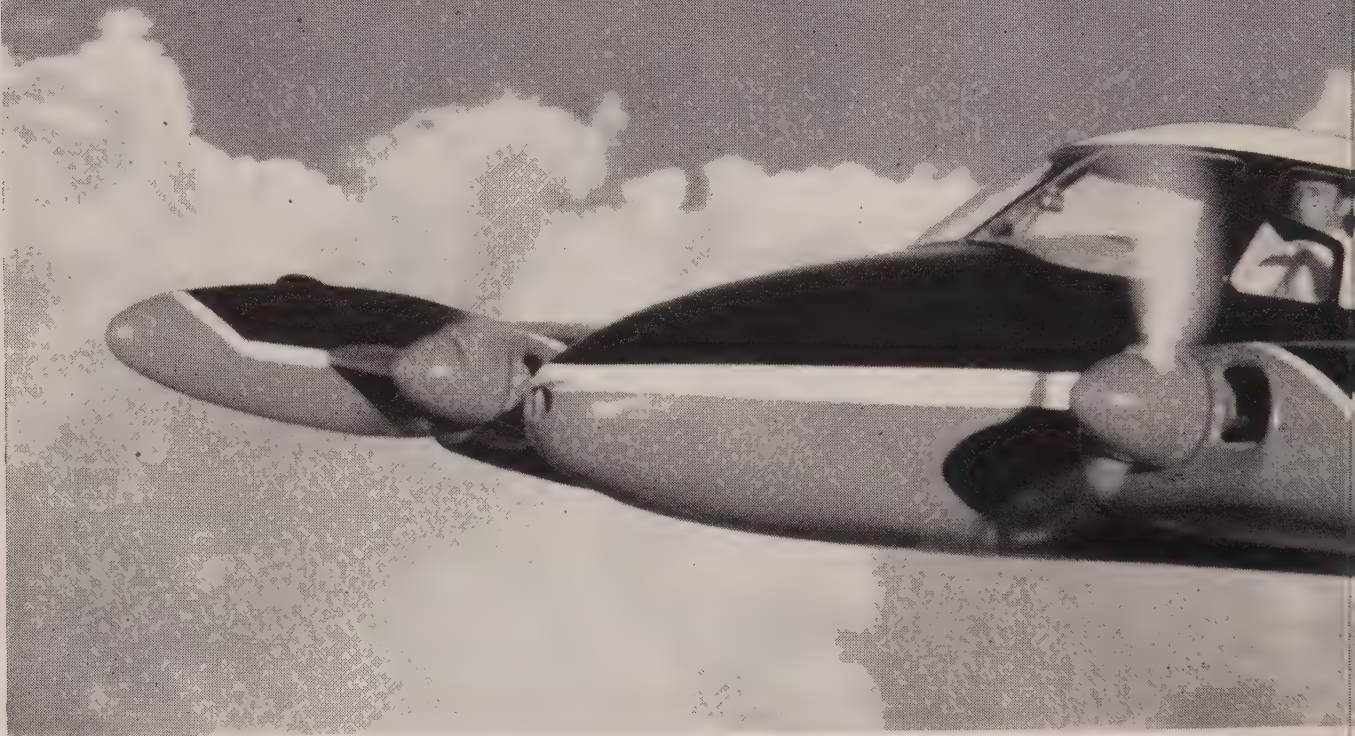


PARTIAL view of the translator exterior. In the background is one of the computers that supply data to cockpit instruments to give realistic readings for any situation. The DC computer is an innovation in American flight trainers, and provides more accurate readings than AC computers.



MIKE GLERUM, Chief Flight Translator Instructor, "cranking in" an emergency for cockpit solution. Any realistic emergency situation can be reproduced by the translator.

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cuts drag; makes take-off, flying, landing easy—simple

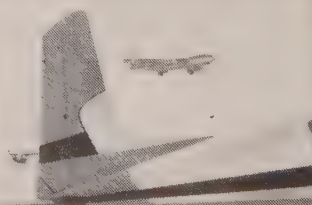
ADVANCED ENGINEERING: Improves power-weight ratio

adds new safety factors, gives new "hush-flight" comfort

Split flaps reduce landing speed



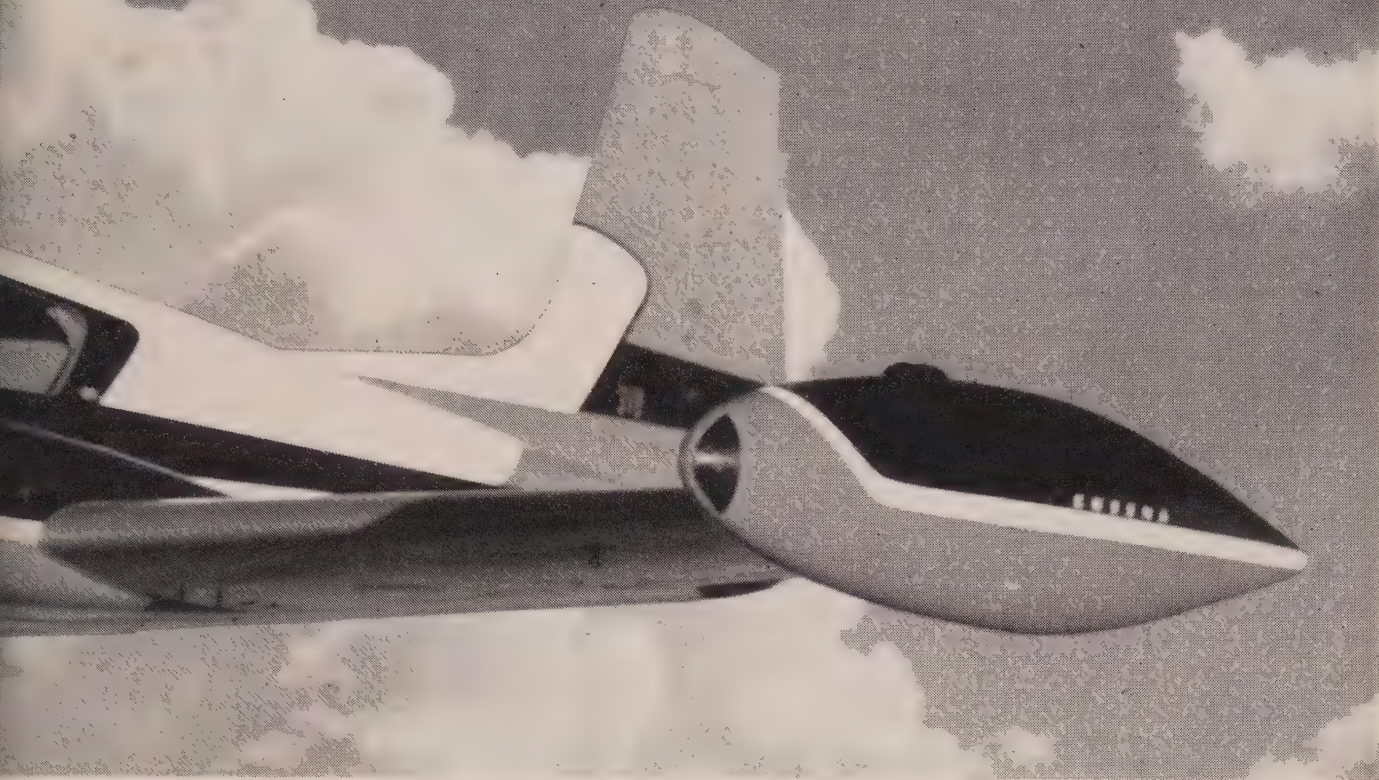
Jet tail gives low-speed stability



21-inch nacelles cut drag and add lift



design, engineering... proved by millions of miles of safe flying



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FOR EVERY BUSINESS NEED

How Freight got its Wings

One G. I. dream that came true resulted in America's first all-freight air line.

One of the great pastimes of the GI's during World War II was no different in kind from that of soldiers during all the wars of history: the building of postwar castles in the air. Most of the dreams were destined to vanish in thin air. One at least was not. That was the one dreamed by the group of enthusiastic young fliers at Brownsville, Texas, who ultimately became the nucleus for one of the first all freight airlines—Slick Airways.

Earl Slick, whose family name was linked to Oklahoma oil, had some money—enough, it seemed to the inexperienced young men, to found an all cargo air service. Actually, it proved pitifully small when the money went out for equipment and the salaries of personnel. When the airline met with initial success and invited the competition of the older, established passenger lines which had previously ignored the freight potential, the great dream often took on the qualities of a nightmare.

But all that was in the future when its first C-46, "the giant Curtiss Commando," took off from San Antonio's Alamo Field for Chicago with its first payload. The date was March 4, 1946. At that time, March 4 was Inauguration Day, a good omen possibly for an inaugural flight. The first plane—and the new venture—were launched. The dream seemed to have become an actuality. But it was a long time before the soundness of the venture could be proved. There was a long educational job needed to interest shippers in moving cargo by air, in proving to business the advantages offered by swift air movement. During that long pull, Slick Airways often seemed literally to be operating "on a wing and a prayer."

The Slick policy from the first had been to blend into a firm's own transportation policies as a kind of big brother to the executive fleet. It had one interest and all its energies were concentrated on that interest: air freight. From the very beginning, Slick wanted to chart a path of responsible, scheduled, certificated service that would offer business and industry a means of swift movement that would often also prove the most economical movement. Slick's efforts were bent to

securing the kind of volume that would enable it to reduce rates enough so air movement would be competitive with surface movement. Its aim was to make air movement feasible for routine shipping, not merely to be utilized for luxury items but for bulk loads.

Slick started out with a preconceived notion that air freight could be handled at considerably less than the rates the passenger lines were then charging to haul it. With its initial costs running at 30¢ per ton mile, Slick had started
(Continued on page 39)



MODERN airfreighters in the sky, modern cargo hauling equipment on the ground, and truck pickups coordinated with flight departures are an integral part of the Slick system. A giant fork-lift is shown raising cartons to the big cargo door level.

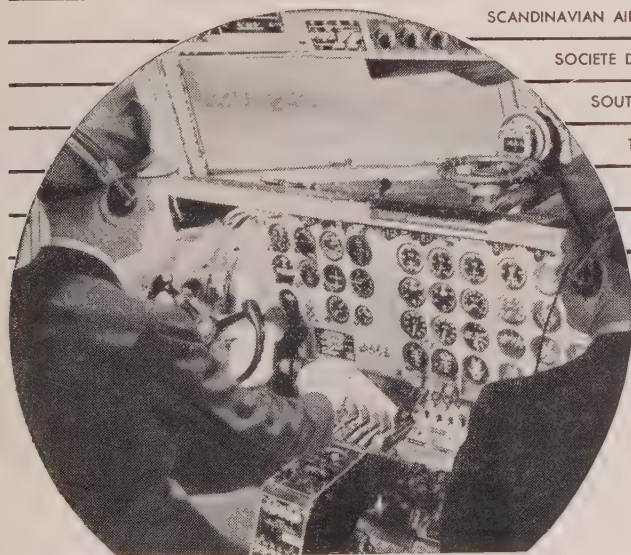
PRIVATE AIRCRAFT OWNERS:

of the major airlines in selecting the best flight airlines themselves[†] on their choice of spark engines and other reciprocating engines.

[†]As determined by survey, September 1, 1955

AIRLINES USING CHAMPION SPARK PLUGS

| | | | | |
|---|---|-----------------------------------|---|---------------------------|
| AER LINGUS | AERO O/Y | AEROLINEAS ARGENTINAS | AEROLINEE ITALIANE INTERNAZIONALI (ALITALIA) | AERONAVES DE MEXICO, S.A. |
| AEROVIAS GUEST, S.A. | AEROVIAS NACIONALES DE COLOMBIA | AEROVIAS VENEZOLANAS, S.A. | AIR ALGERIE | AIR CEYLON, LIMITED |
| AIR FRANCE | AIR INDIA INTERNATIONAL, CORP. | AIR MAROC | ALASKA AIRLINES | ALLEGHENY AIRLINES |
| AUSTRALIAN NATIONAL AIRWAYS | B.O.A.C. | BONANZA AIR LINES | BRAATHENS SOUTH-AMERICAN & FAR EAST AIR TRANSPORT | AMERICAN AIRLINES |
| BRANIFF INTERNATIONAL AIRWAYS | BRITISH GUIANA AIRWAYS, LTD. | CANADIAN PACIFIC AIRLINES, LTD. | CAPITAL AIRLINES | |
| CAT INCORPORATED | CATHAY PACIFIC AIRWAYS, LTD. | CENTRAL AFRICAN AIRWAYS CORP. | CENTRAL AIRLINES | |
| CIA. MEXICANA DE AVIACION, S.A. | COLONIAL AIRLINES | COMPANIA CUBANA DE AVIACION, S.A. | COMPANIA DE AVIACION "FAUCETT" S.A. | |
| CONTINENTAL AIR LINES | DELTA—C & S AIR LINES | DEUTSCHE LUFTHANSA | EASTERN AIR LINES | EAST-WEST AIRLINES, LTD. |
| ETHIOPIAN AIRLINES, INC. | FLUGFELAG ISLANDS, H.F. (ICELAND AIRWAYS, LTD.) | FLYING TIGERS | FRONTIER AIRLINES | |
| GARUDA INDONESIAN AIRWAYS N.V. | HAWAIIAN AIRLINES LIMITED | IBERIA | INDIAN AIRLINES CORP. | IRANIAN AIRWAYS |
| ISRAEL AIRLINES, LTD. | JAPAN AIR LINES | JUGOSLAVENSKI AEROTRANSPORT | KLM ROYAL DUTCH AIRLINES | |
| KOREAN NATIONAL AIRLINES | LAKE CENTRAL AIRLINES | LINEA AEROPOSTAL VENEZOLANA | LINEAS AEREAS DE NICARAGUA S.A. | |
| LINEE AEREE ITALIANE S.P.A. | MACKEY AIR TRANSPORT | MALAYAN AIRWAYS, LTD. | MARITIME CENTRAL AIRWAYS | |
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| NORTH CENTRAL AIRLINES | NORTHEAST AIRLINES | NORTHWEST AIRLINES | OZARK AIR LINES | PACIFIC NORTHERN AIRLINES |
| PAKISTAN INTERNATIONAL AIRWAYS | PANAIR DO BRASIL, S.A. | PAN AMERICAN-GRACE AIRWAYS, INC. | PAN AMERICAN WORLD AIRWAYS | |
| PHILIPPINE AIRLINES | PIEDMONT AIRLINES | PLUNA | QANTAS EMPIRE AIRWAYS, LTD. | REAL-AEROVIAS BRAZIL |
| REAL S.A.-TRANSPORTES AEREOS | RESORT AIRLINES | SABENA | SAUDI-ARABIA AIRLINES | SEABOARD & WESTERN |
| SCANDINAVIAN AIRLINES SYSTEM | SERVICOS AEREOS CRUZEIRO DO SUL, LTDA. | SLICK AIRWAYS | | |
| SOCIETE DES TRANSPORTS AERIENS DE L'EXTREME ORIENT (COSARA) | SOUTH AFRICAN AIRWAYS | | | |
| SOUTHERN AIRWAYS | SOUTHWEST AIRWAYS | SWISSAIR | TAN AIRLINES | |
| TRANS-AUSTRALIA AIRLINES | TRANS-CANADA AIRLINES | TRANS-PACIFIC AIRLINES | | |
| TRANS-TEXAS AIRWAYS | TRANS-WORLD AIRLINES | TURKISH STATE AIRLINES | | |
| TWA—TRANS WORLD AIRLINES | UNITED AIR LINES | VARIG | | |
| VIACAO AEREA SAO PAULO, S/A | WEST COAST AIRLINES | WESTERN AIR LINES | | |



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NOVEMBER 1956

Oklahoma City

Progressive vs. Periodic Maintenance

Round Table participants consider the effect of CAA's new certification regulation on aircraft maintenance, and in discussing the alternative methods express some of the following opinions of the progressive system:

- "You would have to have quite a few airplanes, running pretty much on schedule, before progressive maintenance would pay off."
- "The size of the equipment has a bearing on whether you could use progressive maintenance or not."
- "Progressive maintenance is not as compatible with fixed base operation as it is with executive operation."
- "Progressive maintenance without good records can be dangerous."
- "CAA is not trying to sell progressive maintenance, but it is available if the operator feels that it is more beneficial to him."

W. Buril Barclay (*Business Flying Specialist, CAA, General Safety Div.*): "Gentlemen, we can thank SKYWAYS for assembling this group, and also for its efforts to assist business flying with the problems of business operators encountered while attempting to realize maximum utility from their equipment. Today's topic has to do with maintenance. Recently CAA and CAB made some changes in the regulations which were designed to permit a certain amount of flexibility in the conduct of required maintenance inspection. Specifically, the regulatory changes permit in certain cases the adoption of a continuous or progressive inspection system in lieu of periodic or annual inspections. To begin, it might be well to discuss the merits and limitations of each system. Ferrell Roberts, you are in the maintenance department of Stanolind Oil and Gas. Suppose you give us your views."

Ferrell N. Roberts (*Assistant Aviation Superintendent, Stanolind Oil and Gas Co.*): "In the beginning, our company, like most others, was opposed to the

change. I now believe the change is for everyone's benefit. It has decreased paper work, which is good. As for progressive maintenance versus periodic inspection, a number of airplanes would be required before progressive type maintenance would pay off. To write an inspection procedures manual and all other papers required for progressive maintenance, you must have flights that run on schedule most of the time like the airlines. In our particular operations, with five executive airplanes operating, we do not find that progressive is the answer; we prefer the periodic. However, we use modified progressive maintenance now. We actually take an airplane out of service once each year, as required, but we do perform regular 100-hour inspections. We are not held to any particular time limit. We can do it at our convenience, and in this way we get much more utilization out of the airplanes."

Barclay: "Do you agree that the size of the equipment has a bearing on whether one could use progressive maintenance or not?"



C. L. KRAEMER (center), distinguishes between progressive and preventive maintenance, saying that progressive maintenance may not keep an airplane as reliable as consistent preventive maintenance. **Mark De Groff** (l) and **Leslie Eichem** (r) listen.



FERRELL ROBERTS (l) and **D. U. Howard** (r) listen as **Dave Peterson** argues the need for more publicity on the necessary change of certificate. "Once the word got around," he said, "it was perfectly smooth for all of Sinclair's twenty-six airplanes."



ROUND TABLE PARTICIPANTS (standing, left to right): J. G. Schink, C.A.A.; C. L. Kraemer, American Air Lines; Leslie R. Eichem, C.A.A.; James E. Lockart, Jr.,

Southwest Airmotive Co.; R. M. Byrne, Pacific Airmotive Corp.; Dave Peterson, Sinclair Refining Co.; Ferrell Roberts, Stanolind Oil and Gas Co.; Rex Madeira,

Spartan Aircraft Co.; (seated, left to right): Mark E. De Groff, Medco Products Co.; W. Buril Barclay, C.A.A., Moderator; and D. U. Howard, Howard Aero Inc.

Roberts: "Yes, I think it has."

Barclay: "In other words, the size of the equipment would to a great extent determine the length of time the aircraft had to be laid up for the hundred-hour or the periodic inspection, which would make a lot of difference in the scheduling."

Roberts: "Yes, definitely. For instance, inspection of radio equipment on a large airplane would require more time than to perform a complete inspection on a small airplane."

Barclay: "Les Eichem, as Chief of the General Maintenance Branch in Kansas City, you have been close to this new draft release from the beginning. Did the CAA or the CAB expect or intend to have large numbers of operators change over to the progressive system of inspection at the time this release came out?"

Leslie R. Eichem (Chief, General Maintenance Branch, CAA Regional Office, Kansas City): "My impression was that the progressive was more or less an equivalent to the periodic. In other words, the regulations basically require a periodic inspection, and to understand what a periodic inspection is, I think we should associate it with the old annual inspection. They are approximately one and the same. In other words, we used to have an "annual inspection" once a year; now, by regulation, we have a "periodic inspection" once a year. The old annual was performed by an agent or a Dami. With the new program, Dami's are being

eliminated, and provisions are made whereby A&E mechanics who meet certain requirements can receive an inspection authorization which, in essence, gives them *about* the same privileges as the old Dami. For people who are interested in the ground time of an airplane, or have a fleet of several aircraft, I think progressive lends itself more readily. They can utilize the progressive system if they so desire. CAA, as I understand it, is not encouraging it, and they're not trying to sell it, but it is something that is available if the operator himself feels it is more beneficial to him. I can see certain cases where progressive would be beneficial to certain types of operations.

"Where you are concerned with ground time, and you don't want to tie your airplane up on the ground, you might select one type of progressive where the plane is divided into quarters. You do a quarter of it today, and another quarter next week, or a month following, until you have completed the cycle. With that method, you have your plane down more often, but the down times are much shorter.

"If you have a lot of mechanics, and you have congestion when you're working on the airplane, you might select a progressive system, something similar to what some airlines are using. You again sectionalize the airplane and the work to be done. You may decide, for example, that today you'll do painting and fabric work. The painters and the fabric people won't have elec-

tricians, engine mechanics or metal smiths crowding them out. The next time the airplane is in you may have the engine mechanics to work on it. Using this system, the engine mechanics will not interfere with anyone else working on the airplane.

"The main thing is that progressive maintenance is available for each individual's choice, as he feels it would fit his operation.

"Actually, I don't feel that anyone should be particularly disturbed over the paper work associated with a true progressive system. You go through the same thing, I think, with the periodic, and if you are operating on the progressive, and your utilization is in excess of 100 hours a year, you do have the privilege to increase your inspection periods beyond the normal hundred if operations warrant it.

"Douglas put it out on the DC-3. They've got it all worked out in manual form: Inspections #1, #2, and #3 start at 40, 80 and 120 hours respectively. If you adopt that system, and you find your airplane remains airworthy at the 40-80-120 periods, you might have justification to raise it to 50, 100, and 150. When you stay with the straight periodic, and you don't operate too much, you might sacrifice a little time there, particularly if you're operating 'for hire', because then your checks would be regular 100-hour inspection. The progressive does have certain advantages, especially when 'for hire' enters the picture."

ROUND TABLE PARTICIPANTS



W. BURIL BARCLAY, Moderator, is CAA General Safety Div. specialist in business flying, air taxi, lighter-than-air and jet operations; was fixed base and flying school operator until joining CAA in 1941 as aeronautical inspector; transferred to Washington office in 1949 to work on pilot qualifications.

C. L. KRAEMER, Captain, American Air Lines, has served American for 16 years, including 13 years as pilot and 2½ years as Superintendent of Flying, Flight Test Section of AA's Overhaul and Supply Depot. Owner and operator of five light planes in last 18 years, he represents the private pilot rather than airlines in this discussion.

REX H. MADEIRA, Sales Manager for Aviation Div. of Spartan Aircraft Co., has served with that company for about 15 years; was director of Spartan School of Mechanics and Flight Engineering and Director of Training, Spartan School of Aeronautics.

FERRELL N. ROBERTS, Assistant Aviation Superintendent of Stanolind Oil and Gas Co., has served with that company since 1951. Prior service: Aero Repair and Inspection departments of Spartan Aircraft; Air Force; ATC; Spartan School of Aeronautics; TWA.

R. M. BYRNE, Sales and Service Representative for Pacific Airmotive Corp., Burbank, was Aviation Safety Representative on California Aeronautics Commission from 1948-1955; served with U.S.A.F. Office of Flight Safety; is commercial pilot, SMEL and Instrument.

D. U. HOWARD is President of Howard Aero, Inc., San Antonio, an operation covering nearly all phases of business aviation. Has ten years' experience in executive maintenance, six years' experience in airframe maintenance.

JAMES E. LOCKART, JR., Vice President, Service, of Southwest Airmotive Co., Dallas; has served with that company for ten years.

MARK E. DE GROFF, President of Medco Products Co., Tulsa, is founder of the Flying Physicians Assn., has commercial, multi-engine and instrument ratings; now flying a Twin Apache, flies 500 hours annually in business and coverage of national medical meetings.

LESLIE R. EICHEM, Chief, General Maintenance Branch, CAA Regional Office, Kansas City, Mo., served with CAA Aviation Safety since 1941; was A&E mechanic, inspector and flight engineer with TWA from 1934-1941; is commercial pilot and member of Q.B.

DAVE PETERSON, Chief Pilot for Sinclair Refining Co., Tulsa, started flying in 1930 after building a glider in high school. Charter operator from 1937-1941 and 1947-1950, he worked at Boeing and Beech during war. At present he is developing a twin-engine conversion of Beech Bonanza.

Barclay: "Dave Peterson, do you have any comments to offer on the subject?"

Dave Peterson (Chief Pilot, Sinclair Refining Co.): "The 'for hire' point is what I was going to mention. The taxi operator with several airplanes of the same type, perhaps a Bonanza, can have his progressive maintenance worked out so that he can do the various things and never have to tie the airplane up or take it out of service. The private operator, the oil company operator, that doesn't have to do the 100-hour, will probably continue to do it, but maybe not on exactly the same basis. He doesn't have to tie up his airplane to do the 100-hour. He can run under or over without having to stay within the prescribed grace periods allowed by the CAA."

Barclay: "That's a good point to consider. How about Pacific Airmotive, Bob? Do you have any ideas on these points?"

R. M. Byrne (Sales and Service Representative, Pacific Airmotive Corp.): "At the time the original draft release 54-27 came out, I was with the California Aeronautics Commission. We immediately got loud screams from the corporation operators in our area. Our office was at Pacific Airmotive, where a lot of the corporate planes were based, and the operators came to us in a very vocal group and demanded that the State Aeronautics Commission do some-

thing about it, and intervene in this thing. As it was presented then, they visualized that they would all be forced into progressive maintenance, and that each operator would have to buy a manual for his airplane because no two airplanes, not even two DC-3's in corporation service, are enough alike so that one manual would do for all. They all had visions of paying \$750 or \$1000 for a manual so they could go into progressive maintenance.

"Whether that was true or not I'm not qualified to say, but they all had some pretty good arguments, and they were all very much opposed to the draft release as individually brought out. When the second draft release came out, I had left the Aeronautics Commission, but was still in the same general area, and the loud screams tapered off and nobody seemed to be very unhappy about it.

"In recent weeks, I've contacted corporation operators in our area, and have had some lengthy discussion with our own people who are working with them. As far as Pacific Airmotive, its tenants and its customers are concerned, the present situation seems to be working very satisfactorily, and apparently is not a hardship to anyone."

James E. Lockart, Jr. (Vice President, Service, Southwest Airmotive): "Most of our customers are continuing their 100-hour check and periodic inspection just as they have in the past."

Byrne: "I neglected to say that, as Mr. Roberts said, I feel that most of our customers are performing a modified progressive inspection. Their primary interest is good maintenance; they're going to do the best job they possibly can, no matter what the regulations are. They are trying to set up a maintenance system that is both legal and safe, and still enable them to operate without handicap. From all that I can find out now, they are doing it successfully."

Eichem: "I heard this gentleman mention that several of the operators or personal owners were proceeding on the periodic basis. In that connection, I think all of you could help us in CAA by advising some of these people that, the way the regulations are written at present, any time they permit one of the old airworthiness certificates, that bear an expiration date, to expire before it is changed over to one of the new type, the regulations require that the airplane be inspected by a CAA agent. These people could avoid that, and save themselves a lot of time, if they would just note that the airworthiness certificate is approaching expiration, and present it to an agent who could replace it with a new type."

Byrne: "There seems to be no misunderstanding about that now; it's being handled very smoothly as far as I know."

(Continued on page 54)

Piper's Utility Fleet



PIPER COMANCHE Shown here is the prototype of Piper's new high performance business plane. Now in flight tests, the Comanche will be in production by Spring of 1957.



PIPER APACHE for 1957, all metal executive plane. Low stall speed and short take-off and landing runs permit Apache to operate safely from every designated airport in U. S.



PIPER TRI PACER 150 for 1957. Low fuel consumption, long range and roomy cabin make the 150 ideal for salesmen; tricycle gear, stability and instrumentation ensure safety.



PIPER PA-18-A agricultural plane comes as duster, sprayer, or quick-conversion combination unit. This sprayer has 110-gallon capacity; duster holds 18 cu. ft. of chemical.

The 1957 models of business and utility aircraft produced by NBAA Associate Member Piper Aircraft Corp. were recently unveiled at the 16th annual Piper distributor's meeting. Included at the display were new models of the Piper Apache, twin-engine executive transport, the Tri-Pacer, four-place business plane, the Super Cub, general utility plane, and the PA-18-A, agricultural duster and sprayer. Details are still forthcoming of the new Comanche, to be included in the 1957 lineup.

The new Piper Apache is powered by two Lycoming O-320 150 hp engines with Hartzell full-feathering propellers. At the recommended 75% cruise power, speed at 6000 feet is 170 mph. Except for the Super Custom, which has a range of 1200 miles on 108 gallons of fuel, the Apache carries 72 gallons of fuel for a range of about four hours.

The 1957 Apache has higher capacity carburetor heaters, and carburetor air temperature gauges are now standard equipment. Graduated scales on the throttle quadrant permit easier positioning of controls to the desired setting.

Standard equipment on the Apache also include complete instrumentation for instrument flying. The Custom model is factory equipped with Lear ADF with hermetically sealed loops, Narco Omnigator (combination VHF transmitter, receiver, 75 Mc marker beacon and ILS localizer function) plus a separate Narco 27-channel transmitter and receiver.

Standard four-place seating can be altered to reclining airline-type seats or seating for five passengers.

The 1957 Tri-Pacer has a 150 hp Lycoming engine, cruises (75% power at 7000 feet) at 132 mph, has a standard range of over 500 miles on 36 gallons of fuel, an extended range, using an 8-gallon auxiliary tank, of over 600 miles.

Rudder and aileron controls are interconnected with springs, to permit coordinated turns with wheel or rudder pedals alone.

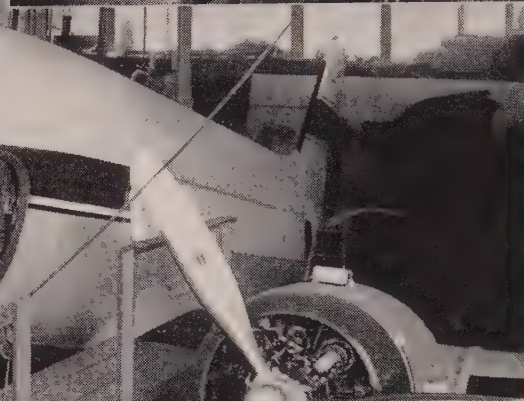
The Super Custom model, which has accounted for about two-thirds of Tri-Pacer sales, includes full instrumentation with all gyro and other flight instruments mounted directly in front of the pilot. Narco Superhomer with multi-channel transmitter, VHF receiver and VOR navigation system, plus low frequency range and standard broadcast receiver are center-mounted with engine instruments. A fixed homing loop aft of the passenger section permits homing on range or standard broadcast stations.

The Piper Super Cub will be offered in 1957 in two versions. The 95, in wide use in flying schools and general utility work, has a 90 hp Continental engine; the 150 is powered by a Lycoming 150 hp engine. Equipped with flaps, the 150 will take off and land in 50 yards.

The agricultural version of the Super Cub, the PA-18-A, is available as a duster, sprayer, or a combination unit which is convertible for application of dry or liquid chemicals. It is equipped with a hopper with a capacity of 110 gallons of liquid or 18 cubic feet of dust.



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Devoted to information regarding the operation of business aircraft from first scheduling through flight completion, and the factors bearing on those operations, such as facilities, equipment, problems of navigation and communications, airspace regulations, new ATC procedures and new flying techniques. Comments and suggestions are invited.

Radar Approach Control Started At LaGuardia

The accompanying diagram, based on latest RF and Jeppesen charts, illustrates the inbound routes to and from the new LGA primary approach patterns, using radar to feed the ILS front and back courses serving Runway 4-22.

Attention is called to the fact that all four patterns serving LGA, NEWARK, IDLEWILD, GLEN COVE and MEADOWBROOK are one-minute right-hand patterns. The middle marker patterns at HOLMES are eliminated, and the FLATBUSH-NEW ROCHELLE patterns are not employed for holding, except in the event of radar failure or missed approach.

The OUTER MARKER holding pattern serving NEWARK is reversible according to the flow of traffic in the area. Inbound LGA traffic from the west via V-10 now separates from V-6 at SELINGSGROVE and proceeds via

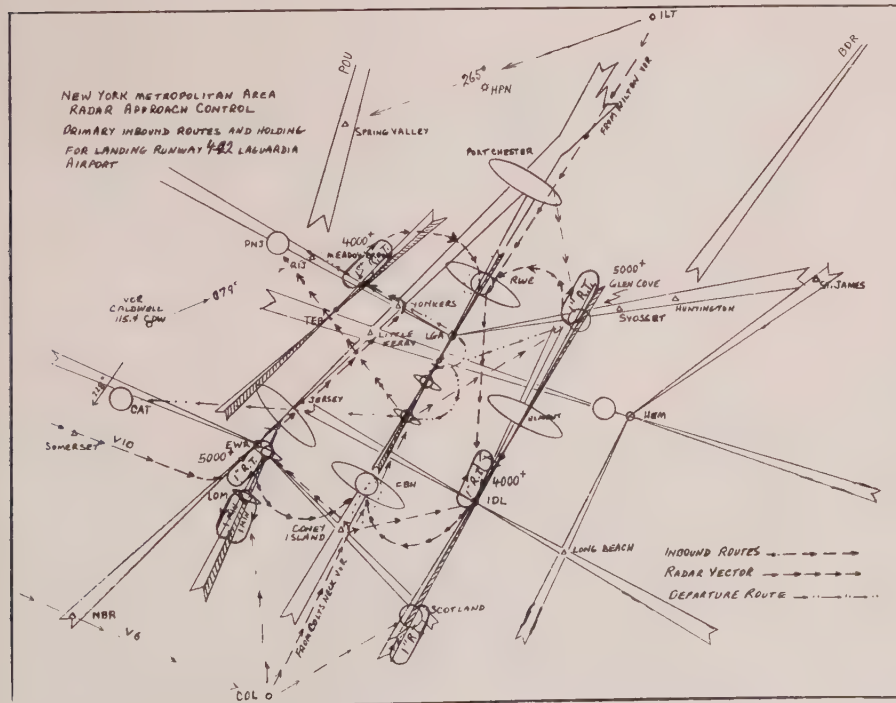
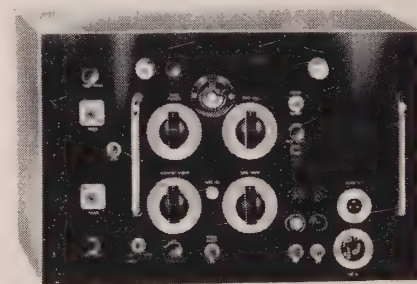
STROUDSBURG. NEWARK and IDLEWILD traffic from west will use V-6 to COLTS NECK, then direct to the EWR LOR or SCOTLAND patterns. (Other N Y Area patterns and inbound routes are comparatively unaffected, hence not shown—refer to your current charts.)

Electronic "Seeing Eye" Automatically Sounds Warning Alarm

A new electronic device that automatically monitors or "watches" radar, and sounds its own warning alarm when an object is sighted in a specific range or area selected by its operator, has special interest to aviation in the light of the current concern over collision-avoidance. Its inventor, Mr. Richard R. Miller of Terminal Radio International, Ltd. of New York, explained and operated the new device called a "Raytector" at a special showing for the press and military. He suggested that Raytector could electronically monitor ordinary radar sets with possibly greater accuracy and dependability than could human operators. The apparatus automatically sounds an alarm when any distant object is picked up by the radar. It also sounds an alarm if either the Raytector or the radar apparatus itself fails in its own operation.

The Raytector equipment in operation is said to be capable of greatly

increasing safety on the high seas, in aircraft, or on land by reducing the dependence on human operators subject to so-called "radar hypnosis," a mental numbness induced by prolonged staring at the radar screen. Of more immediate concern is the requirement of airborne radar currently available to commercial aircraft crews, of "head-down and locked" study of the light shielded scope, obviously intolerable in hi-density areas. If the ability to select only potentially hazardous targets with respect to azimuth, altitude, or angle-of-closure, can be designed into the Raytector, its future development and application may be the desperately sought solution to the anticollision problem only partially met by current "proximity indicator" radars. The new Raytector operates only on the video input signal of the radar set and therefore in no possible way interferes with radar's normal opera-



tion. Since Raytector automatically notifies in case of failure of either instrument, it is held that Raytector cannot introduce technical operating hazards to the existing radar but can only add to its efficiency and lower its operating costs.

The general function of radar is based on the principle that reasonably dense masses (objects) will 'reflect' an electrical energy beam much as a mirror reflects a beam of light or a wall reflects sound. Radar is essentially the projection of a concentrated, rotating beam of electrical energy. In the event some distant object reflects any of this radiated energy back to the radar source the reflecting object is immediately indicated by a white spot on a screen in front of the operator. Having thus 'sighted' the target (object) an operator can calculate its exact position. The radar screen is exactly like a TV screen without a picture.

This white spot, or 'blip' as it is called, is what the radar operator watches for. The Raytector, in operation, receives this returning 'echo' impulse on its way to the radar screen.

Raytector employs this tiny impulse as the triggering stimulus to set off the audio and/or visual alarm mechanism which is the prime purpose of Raytector. Capturing this "echo" impulse and transforming it into some sort of alarm signal is not so terribly difficult, electronically. Raytector, however, devotes most of its ingenious circuitry to vital and intricate 'rejection' processes.

Raytector carefully manages to sound its alarm only when a real object or target has been sighted by the radar. It rejects all extraneous disturbances such as incidental white flecks, snow, etc. Raytector distinguishes between true echoes and "false" echoes caused by momentary "false" targets. These are important factors which make the new device a valuable aid instead of an over-sensitive nuisance.

Raytector can be readily adjusted to require any number of 'repeat confirmations' before sounding its alarm. Each repeat delay interval is equal to the time it takes the radar antenna to make one revolution. This suggests another possibility. Consider if, after say three repeats, the progress of a potentially conflicting aircraft target indicates a "constant bearing" or collision course, or an altitude or speed factor that poses a threat, an analyzing or computing circuit associated with the Raytector would sound the alarm and the pilot would examine the situation and take necessary evasive action.

In this respect, Raytector does now select and limit its own operation to specific search ranges and areas determined by the operator, rejecting all echo signals from nearer zones, or ranges beyond the desired search limit. This permits Raytector to perform useful search functions in the presence of nearby temporary or "fixed" reflective objects which would otherwise keep reappearing as targets and repeatedly set off the alarm mechanism.

As an added safety, Raytector thoughtfully provides for its own failure, or the failure of the radar equipment itself by setting up an automatic alarm if either apparatus fails to function. In this event, the supervising technician is immediately summoned to investigate. In the event Raytector has failed, a signal light indicates that part of the equipment in which the failure exists.

Raytector is probably more efficient than even human operators at peak efficiency, but in any event, the device makes it possible for the operator to be self-relieved at more frequent intervals, a factor greatly increasing his alertness over extended periods. In possible traffic control radar applications, Raytector could not only monitor the desired minimum separation between enroute aircraft against possible human failure and reduce position manning requirements, but could automatically monitor the tolerances of low instrument approaches.

Radar, combined with Raytector, is expected to seriously encourage more extensive use of search radar in appli-

Air-Aids Spotlight

AKRON, Ohio—*WINGFOOT* intersection renamed *DERBY*.

ANTHONY, Kan. — *VOR* shut down temporarily.

BEDFORD, Mass.—*ILS* localizer commissioned on 109.5 mc, "*BED*" *Glide Slope* 332.6 mc.

BELLINGHAM, Wash. — *On* straight-in *LF* *Range* approach, circling minimums of 600—1½ apply if *ADF* not used on final between station and Runway 12.

BIRMINGHAM, Ala. — *VOR* shut down for relocation about 10 n. mi. NW of airport.

BURBANK, Cal. — *Surveillance Radar* commissioned on all tower frequencies.

CAMPBELLTON, Ga. — *LF* *Range* decommissioned.

CHARLESTON, W. Va. — *Experimental ILS* *Glide Slope* signals available only within $\pm 2\frac{1}{2}^\circ$ of localizer "on course."

DAYTON, Ohio—*At press time*, *RF* charts and approach plates show tower frequency 120.7 as announced in July *AIR GUIDE* which now shows 119.5, old frequency. Add 125.7 mc to tower frequencies.

FARGO, N. D.—*VOR* shut down temporarily.

FT. WORTH, Tex.—*VOR* shut down for relocation and frequency change to 116.5 mc.

GRANTSBURG, Wis. — *VOR* shut down temporarily.

HASSAYAMPA, Ariz. — *VOR* shut down temporarily.

HICKORY, N. C.—*VARange* decommissioned. *VOR* scheduled for March 1957.

KREMMLING, Col.—*VOR* frequency changed to 113.8 mc.

LA GRANGE, Ga.—*VOR* shut down for relocation about 8 s. mi. NW of airport.

LITTLE ROCK, Ark.—*ILS* recommissioned on 110.3 mc, *Glide Slope* 335.0 mc, "*LIT.*" *Altitude* over LOM 1800' MSL, over LMM 500' MSL, *Back Course* unusable.

LONGBEACH, Cal.—*Straight-in ILS* minimums are 400-1 without *Glide Slope*.

MERIDIAN, Miss. — *VOR* shut down for relocation about 3.3 mi. NW of airport on new frequency 115.4.

MONTGOMERY, Ala. — *DANNELLY FIELD ILS* *Glide Slope*, middle marker and compass locator shut down for relocation.

NEWPORT, Ore.—*VOR* due decommissioning account site difficulties.

OHIO AREA — *New omni's* at CHARDON and JEFFERSON site test operation on 117.5 and 115.2 respectively.

PLATTSBURG, N. Y. — *Aircraft* inbound to municipal airport check PLATTSBURG or BURLINGTON RADIO or AFB tower or Municipal Airport Unicom for VFR flight restrictions in AFB Control Zone. *NON-RADIO* weather minimums 2500'—3 mi.

SAN FRANCISCO, Cal.—*VOR* name and identification changed to AGNEW, "AGW."

TUCSON, Ariz.—*GILPIN FM* identification now keying "A." *ILS* localizer installation progressing nicely.

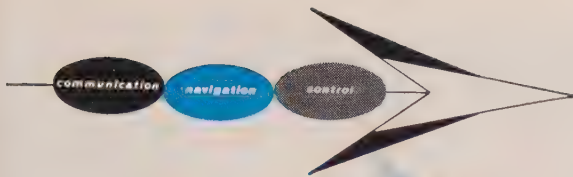
WAUSAU, Wis. — *VOR* shut down temporarily.

SPECIAL NOTE—*ATC* requests that *IFR* climbs and descents be made at maximum practicable rate except for the last 1000' prior to reaching an assigned altitude, which should be made at the standard 500' rate of climb or descent.

cations where the costs for technical personnel for 'round-the-clock operation have heretofore been prohibitive. The cost of Raytector is well within the limits practical for broad application. For military use Raytector permits far more efficient use of technical manpower by reducing the personnel required to maintain search radar posts. Raytector's use in other types of applications such as aircraft, railroad trains, burglar alarms, etc. is being investigated. Its use in Civil Defense and in

conjunction with the activities of the Ground Observer Corps is also being explored.

Mr. Miller is head of Miller Associates, an organization interested in the development of electronic monitoring devices. He is a resident of Lakeville, Conn., where he is an instructor at Hotchkiss School, a private school for boys, in Lakeville. Mr. Miller is 42 years old, married and the father of two children. His interest and skill in electronics stems from his training and



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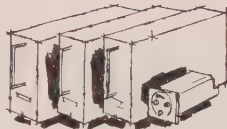


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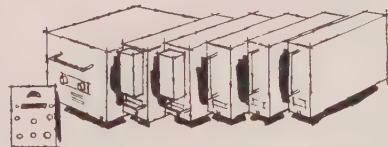
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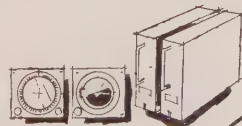
COMMUNICATION



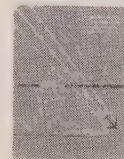
NAVIGATION



CONTROL



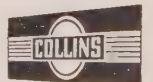
Each of these units is complete—with integral power supply. This System gives complete services of dual VHF Transmitter and Receiver, dual VOR, Automatic Direction Finder System, Marker Beacon Receiver, Glideslope Receiver and Integrated Flight System. An example of Collins new electronic System's space economy is the 17L-8 3 watt VHF Transmitter in a panel mounted 3" instrument case.



Call your nearest sales office for information or write for the new Airborne Electronic System for Twin Engine Aircraft brochure.

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work in radar and electronics while serving in the U.S. Navy during World War II.

Miller Associates is represented for exports by Terminal Radio International Ltd., exclusive world-wide distributors for Raytector.

Miniature Airborne TV Has Commercial Potential

Development by RCA of a revolutionary military image-orthicon television camera—smallest and lightest as well as first completely transistorized camera of its type ever designed has been announced.



Designed for military requirements, the transistorized TV camera is completely portable, and is expected to develop a wide range of applications in ground and airborne military television operations. It can be used for both military on-air or closed-circuit telecasting, adding additional interest for later commercial applications.

"The new RCA camera weighs only 31 pounds, operates on less power than is needed to light a 50-watt bulb, and is independently self-contained in a case smaller than an overnight bag," said an RCA spokesman. It is designed for operation from DC power sources normally used by military aircraft and vehicles.

"The RCA transistorized camera makes available a revolutionary medium for advancing importantly the application of television to ground-to-ground, air-to-ground, and air-to-air operations. The comparatively negligible size, weight, and power requirements of this development give new meaning to the portability and air transportability of military television equipment. When and if commercially available, airborne news reporting by immediate transmission to ground networks suggest tremendous possibilities. Other applications to working utility aircraft missions such as survey, patrol, etc. are unlimited.

"Representing more than two years of pioneering research and engineering by the RCA Surface Communications Department, the military TV camera utilizes a standard image-orthicon television camera tube, transistors throughout, and numerous unique transistor circuits especially designed to solve imposing engineering problems presented by the new approach to TV camera design. The camera fully realizes the sensitivity characteristic of image-orthicon tubes, and is especially suited for ap-

plications requiring high sensitivity under conditions of low light levels."

Emphasizing the space, weight, and power advantages of the transistorized camera, it was pointed out that:

1. Its weight of only 31 pounds compares with the 600-pound weight of conventional image-orthicon camera chains used in military TV service.

2. Its requirement of only 50 watts of power compares with the 2,000 watts required by standard camera chains.

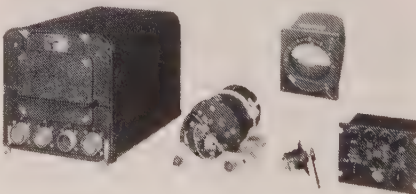
3. All heretofore required external equipment is eliminated, introducing a new level of freedom in camera movement and flexibility. All components essential for camera operation are housed with the image-orthicon tube in a compact camera case measuring only 20 inches long, 9 inches high, and 6 inches deep. The incorporation of such normally external components as tube power supply, sync generator, and video amplifier eliminates two six-foot relay racks or three portable cases of equipment. The self-contained camera requires only a power source for operation.

4. It utilizes a standard lightweight photographic tripod, quickly attached and detached, eliminating the appreciably larger and heavier pedestals usually required for image-orthicon camera operations.

5. In most cases, the camera can be used as a direct replacement for conventional image-orthicon cameras now used in military applications. Built-in remote controls provide for operation of the camera from up to 100 feet away.

Attitude Indicator Aids Copter IFR Operations

An attitude indicating system has been developed by Lear, Inc., to provide improved blind flying capacities for helicopters. Designated Model 4005H, the new vertical gyro indicator is completely transistorized for increased reliability and compactness. It has been specified as standard equipment for the Navy HUS-1 and HR2S helicopters following completion of a flight testing program initiated by the Bureau of Aeronautics, Airborne Equipment Div., Instruments Branch. The



new instrument is integrated with the autopilot amplifier which is now being supplied by Lear in production quantities along with the altitude control, control panel, and other components of the flight stabilization system.

The Model 4005H indicates pitch and roll attitudes by motions of a universally mounted sphere painted to resem-

ble earth, sky and horizon. The hermetically sealed indicator unit also contains the miniaturized transistor amplifier.

In the HUS-1 and HR2S applications the indicator uses as its reference the vertical gyro installed in the Lear-supplied autopilot amplifier.

The newly developed gyro, of all steel construction, provides for the first time nearly constant drift rates at both very high and very low operating temperatures.

Substantial accuracy gains over conventional gyros are reflected in improved system performance for both the autopilot and VGI systems. Indicator sensitivity is $\frac{1}{4}$ degree. Follow-up rates for the 4005H system are 300° per second in roll, and 180° per second in pitch.

A new system of integral lighting offers improvements over conventional attitude instruments in flight attitude interpretation during night flying. In the Model 4005H, the moving background sphere is fabricated of translucent plastic.

Miniature light bulbs of extremely long life are sealed within it to cause the background sphere itself to glow with the red light standard for Navy instrument panel lighting. As a result, the attitude recognition advantages of the two-tone earth-sky moving background are undiminished under night lighting conditions.

A special design feature for helicopter application provides for pilot-adjusted electrical roll trim in addition to the electrical pitch trim which is standard on all Lear VGI systems for fixed-wing aircraft. Electrical roll trim is an innovation necessitated by the unusual flight attitudes of which the helicopter is capable.

Modification of Narco Transceiver Permits Cross-Banding

There are many operational circumstances under which crossbanding, or use of different transmitting and receiving frequencies in a two-way radio contact, is preferable to simplex operation. Examples are—lessening of congestion on busy airport control frequencies, easier timing of transmitting contacts, receiving on navigational and approach aid frequencies and transmitting on common or appropriate communications frequencies, etc. The ability to cross-band is normally unavailable in many crystal-controlled multi-frequency transceivers.

Narco advises that this capability can be added to their Sapphire line 1016 transceiver by a method described in a Service Bulletin to their distributors and service outlets. They also advise that a two-position switch can be additionally installed in the 1016 so as to enable a pilot to pre-select two VHF simplex channels in anticipation of the need for a rapid switch-over as in the case of active runway frequency to departure control or ground control frequency.

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Sec'y. of Commerce Weeks Addresses State Aviation Officials On Development Programs

In an address delivered before the 25th annual meeting of the National Association of State Aviation Officials, Secretary of Commerce Sinclair Weeks described the Federal navigation improvement program, and discussed the VORTAC system, business aviation, and CAA's program for the development of state airport facilities.

Regarding the air traffic control problem, Secretary Weeks said,

"We are embarked on the largest air traffic control and navigation improvement program in the history of the country. You also know and are closely associated with our most substantial Federal aid airport assistance effort which is going forward at the rate of some \$63,000,000 a year in Federal funds, along with the matching funds which are going into this program from the states, counties, and communities. With respect to those two major programs, we are even now planning for their extension and continuance in order that we may keep pace with the growth of American aviation."

Secretary Weeks described the VORTAC system of integrated civil and military air navigation control as provision for "the most comprehensive and modern directional and distance measuring navigation service" throughout the U.S. "This system . . . will accommodate the needs of thousands of private and business airplane owners by continued and expanded implementation of VOR into the long term future."

He also marked the development of business aviation, saying, "Executive flying now involves thousands of company planes, including more multi-engine aircraft than all of the airlines put together. It involves private flying,

agricultural flying, flight school operations, as well as many other types of flying, all of which together log at least twice as many miles a year as do the airlines."

Secretary Weeks observed that the full value of aircraft cannot be exploited without adequate air traffic control, and that as a result of increasing congestion of the airways the original five year Federal Airway Plan was being telescoped for completion in three years. Citing the need for a more nearly automatic flight control system to accommodate the higher speeds and greater density of present air traffic, he said that "the CAA Technical Development Center has prepared a five-year development plan which envisions increasing use of computers and other automatic tools to perform many of the functions involved in air traffic control."

He added that CAA's plans for air traffic control included consideration of closed-circuit television.

In discussing state operation of air navigation facilities, Secretary Weeks noted that, although CAA maintains its policy of encouraging states to operate air navigation facilities supplementary to the Federal system, there are still areas, for example intra-state civil aviation, in which states may make valuable contribution to general flight navigation safety.

"Of particular interest to the states," he said, "is our plan to develop and announce the fiscal year 1958 program early in calendar year 1957, or from five to six months in advance of the beginning of fiscal 1958. This early announcement of the 1958 program will enable sponsors to prepare plans, specifications and other project documentation, thus enabling them to commence construction as soon as the grant offer can be issued by the CAA."

"Under the programs which were announced for fiscal years 1956 and 1957, it is contemplated that 47 new airports will be constructed at a cost in Federal funds of \$5.7 million, and 502 existing airports will be improved at an estimated Federal cost of \$85.1 million."

Secretary Weeks concluded his address by saying that the "understanding and support of interested groups" is essential if the navigation and facilities problems are to keep pace with the technological development of aviation.

Safety, Service, Convenience At Baltimore Friendship Airport

The tremendous increase in the number and importance of business aircraft has produced an air traffic pattern at the Washington, D. C. airport that is



NBAA MIAMI ARRANGEMENTS COMMITTEE (standing, left to right): K. E. Benson, Chairman Exhibits Committee; R. W. Vestal, Treasurer; J. E. Oyer, Member, Travel-Transportation Committee; R. Stuart Skidmore, Chairman, Program Committee; Ray Smith, Chairman, Public Relations Committee; Larry Mansfield, Accommodations; (seated, left to right): Mrs. Ruth Knott, Secretary, Miami Arrangements Committee; Alan Baskin, Chairman, Miami Arrangements Committee; and Mrs. Isabel McKay, Chairman, Entertainment Committee. Also serving on the Arrangements Committee, but not shown, are: Mrs. Kitty Markham, Chairman, Transportation Committee; Miss Carla Markham, Member, Transportation Committee; and Hermann Walker, Jr., Chairman, Finance Committee.

congested, slow and dangerous. In view of the anticipated future increase in business aviation, the D. C. airport traffic problem has assumed national importance.

The use of Friendship Airport as the air-gateway to the Washington-Baltimore area is an outstanding and immediately practicable solution.

The facilities of Baltimore Friendship Airport are the most complete available to the business pilot. However, recent surveys indicate that pilots of business aircraft often feel that Friendship Airport is too far from Washington to be convenient.

Pan-Maryland Airways, which sponsored the survey, has disclosed that the trip from metropolitan Washington to the airport takes only 40 minutes on the Baltimore-Friendship-Washington Expressway; the trip from the airport to Baltimore takes only 20 minutes.

Pan-Maryland Airways has also undertaken to relieve business pilots of the concern that the facilities at Friendship were inadequate; Pan-Maryland will now make hotel reservations, reserve transportation, and accord professional maintenance, servicing and housing facilities for ships stopping at Friendship.

Fine facilities, convenience to Washington, and freedom from the high-density traffic problem make Baltimore Friendship the logical terminal for your next flight to Washington.

(Continued on page 44)



CONVENIENCE AND SAFETY recommend Friendship to business pilots. G. B. Fenwick, Pan Maryland President, talks with F. Yeagle, Pilot for Continental Can Co.



TRANSPORTATION and hotel reservation services are available to business pilots at Baltimore Friendship.

NBAA Membership

Information regarding regular or Associate Membership in the National Business Aircraft Association is readily secured by writing to the Executive Director and Secretary of NBAA at 344 Pennsylvania Building, Washington 4, D.C.

Membership in this non-profit and independent aviation organization is based on the recognition of business flying problems common to all users of aircraft for their business purposes and to those engaged in supporting the operation, servicing, equipment, and manufacture of business aircraft.

Among the fields in which NBAA is concerned are: improvements in airways and airports, better weather service, expansion in communications and air navigation facilities, higher standards of airport services, improved aircraft parts distribution, equitable tax rulings for business aircraft operations, greater recognition of the airplane as a necessary tool in modern business and industry, better air traffic control procedures, professional status for qualified business pilots, and aircraft designed to meet the special requirements of business flying.

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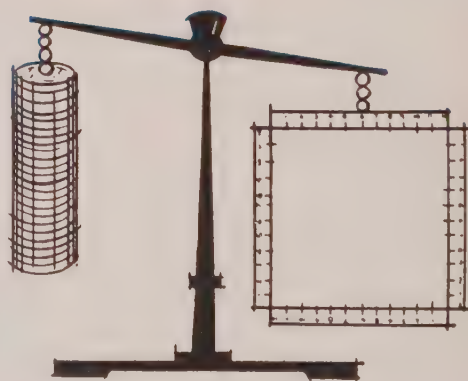


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*Consult the yellow pages of your local telephone directory under AMERICAN PAMCOR, INC., for local telephone center number.

How Freight Got Wings

(Continued from page 22)

by offering a rate of 18¢ and, within a month or two, further reduced this to 14¢ per ton mile. This compared with the 60¢ rate which the carriers had been getting prior to the formation of the first all-cargo air line, Flying Tigers, in 1945.

This bold move on the part of Slick in its bid for volume produced a volume far greater than it had anticipated. No businessman failed to appreciate what speed meant if his product was a perishable or seasonable one. Slick gambled on what air would mean to such industries as the apparel trades where, in many cases, the introduction of a new fashion called for split-second timing. The other advantages of air movement, which have since become commonplace knowledge among businessmen, were plugged by Slick's salesmen, who were often pilots as well: Savings in storage; less breakage and pilferage and consequently fewer claim filings with their attendant cost and annoyance; lower insurance premiums resulting from smoother handling; less transferring and less time in transit; better inventory control and the possibility of smaller stocks proving adequate; these were among the "hidden" advantages the Slick salesman—even as he does today—used to demonstrate why business should use air freight service. Business showed that given the rate incentive and the hidden advantages of air, it would respond.

The success of the Slick policy and the Slick selling program were beyond dispute. From the day of its first contract carrier business, Slick Airways was a bigger air freight carrier than the carriers who had been certificated and licensed for freight years before but whose main interest had always been passengers. The situation immediately after the war helped, of course. Many items had been in short supply and business in general needed many items fast. Cargo was as varied then as now. In Slick's first year of air freight operation, its cargo included Peruvian gold, automobile parts, seven racing cars in one shipment, animals galore, and, probably to demonstrate the fact that "there's music in the air," a shipment of fifteen pianos moving from Philadelphia to San Antonio. Slick finished the year with a record of 11,198,594 ton miles flown. This contrasted strikingly with the total of all U.S. air freight flown in the previous year, 1945: a mere 1,227,527 ton miles.

Slick showed that, given the right rates and service, business would use air freight service. The phenomenal amount it flew in its first year proved that. But the young airline and the young pilots, with their 25-year-old president, found that other factors than the generating of cargo entered into the picture. Competition from long-established carriers, inadequate capital, weather conditions resulting in the loss of equipment and the deaths of old buddies, all brought maturity of the line and the men the hard way. Often

(Continued on page 68)



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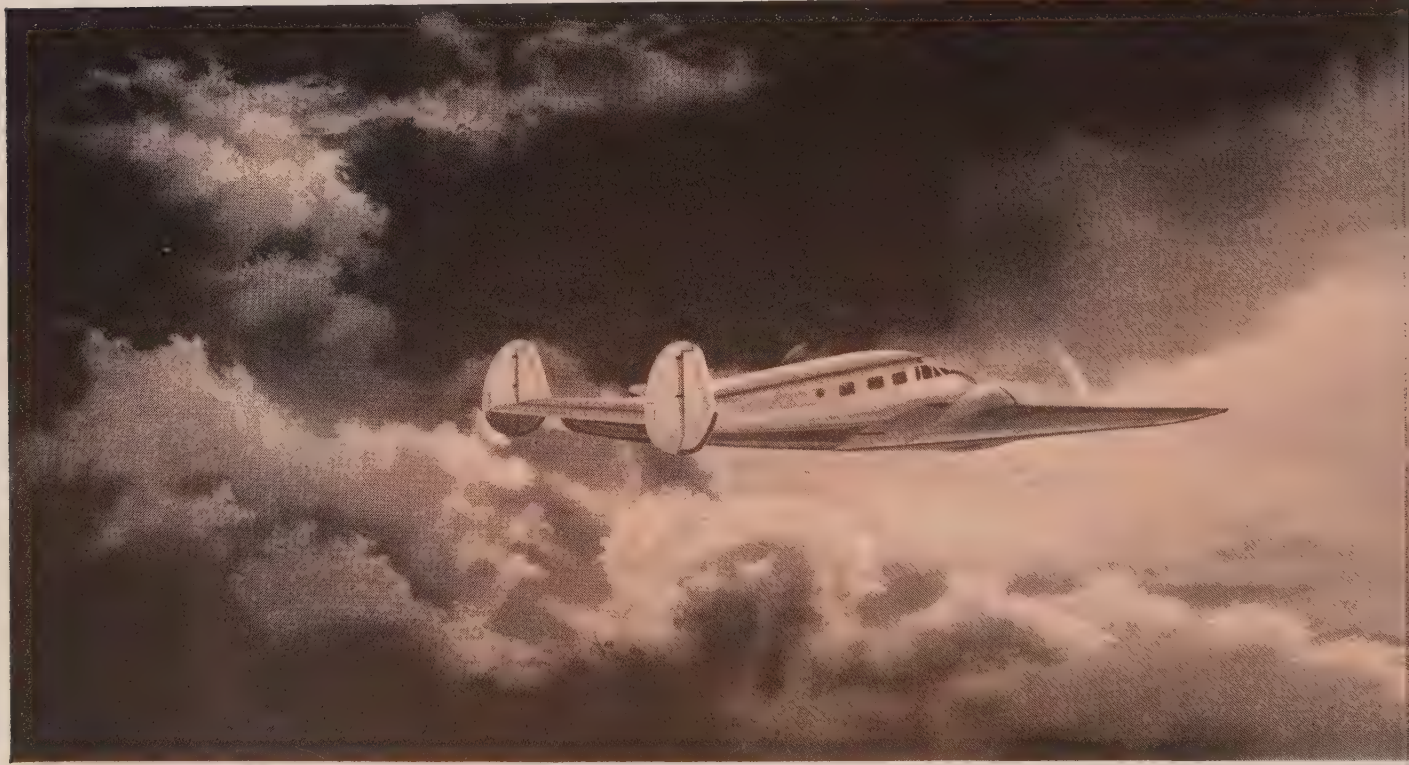


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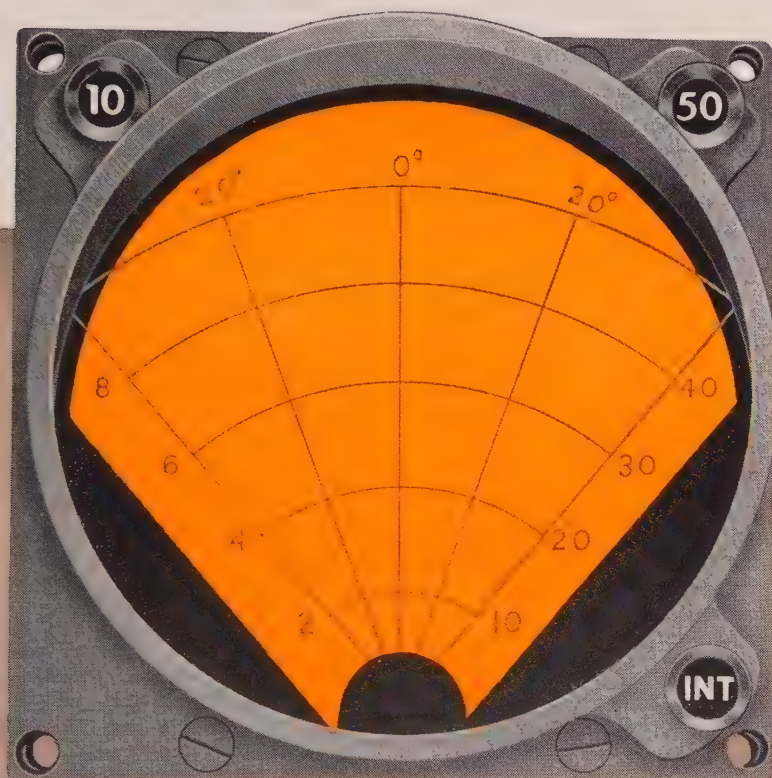
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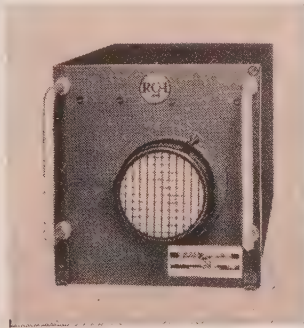


Indicator—actual size for Standard Instrument-Panel Mounting

Accessory Unit



Receiver-Transmitter



Antenna



Typical Antenna Installation in Beech D-18



maintenance

This department covers cost-cutting, time-saving methods and devices for maintaining industrial aircraft efficiency. Technical tips from engine, airframe, electronic, instrument and other components manufacturers, CAA and AD notices, and other sources will be covered. Readers are invited to share their individual mechanical "know-how" with SKYWAYS editors, that it may be disseminated to all operators interested in business flying.

Department of Commerce General Maintenance Checklist

The following general maintenance inspection aids are excerpts of interest to the owners and operators of business aircraft from the CAA checklist No. 056.

Aero Commander Model 520—Lower Rudder Torque Tube Support Bracket: Lower rudder torque tube bearing clock support bracket, which is riveted to the fuselage structure, was found cracked across the two bolt holes which are used to anchor the bearing block. This aluminum bracket, which extends across the fuselage at the second bulkhead from the tail cone consist of two 90 degree bends, making inspection of the anchor block difficult through the inspection hole provided.

Beechcraft Model F-35—Fuel Tank Cap: On draining the fuel tanks, an excessive amount of paint chips was noted. Investigation disclosed paint chipped from fuel tank cap.

Beechcraft Model G-35—Fuel Tank Cap: An increasing number of reports are being received describing a condition of the fuel filler cap rubber plug which occupies the filler neck when cap is in place tearing off in pieces when the filler cap is removed. Obviously, this condition is not conducive to free fuel flow at the tank outlet. Some operators report that adding a gasket approximately $\frac{1}{8}$ " thick under the tank cap will prevent the rubber plug from extending too far into the filler neck, thereby keeping it intact.

Boeing Model A75—Aluminum Casting That Fastens the Lower End of Seat Post to Fuselage: An agricultural dusting operator reported that during inspection of several aircraft, the subject aluminum casting was found corroded internally, resulting from water being trapped in the affected part. It is recommended that seats be removed and the subject part be inspected.

Cessna Model 140 (Continental 85)—Propeller Attaching Bolts: During

installation of propeller spinner, mechanic noticed loose bolt. Further investigation revealed that one bolt was completely broken approximately $\frac{1}{2}$ " from threaded end and that another bolt was about 80% severed approximately $\frac{1}{2}$ " from threaded end.

Cessna Model 170—Wing Skin Wears Into Wing Flap Skin P/N-0523007-42: During inspection it was found that the wing trailing edge had been chafing the flap skin. The wing trailing edge was not in correct alignment to ensure flap clearance.

Cessna Model 170B—Door Hinge Pin P/N-NAS41-2-1625: On attempt to close cabin door, failure occurred, resulting in the door falling to the ground. Inspection disclosed that the hinge pins had sheared. Further, it was found that the hinge pins were worn 50% of their original diameter.

Cessna Model 310—Rudder Torque Tube P/N-08310000-48: An inspection of the empennage, following tie-down of the aircraft in a strong wind, disclosed that the six rivets used to attach the flange to the rudder torque tube failed. Cessna Service News Letter dated January 12, 1955, outlined the

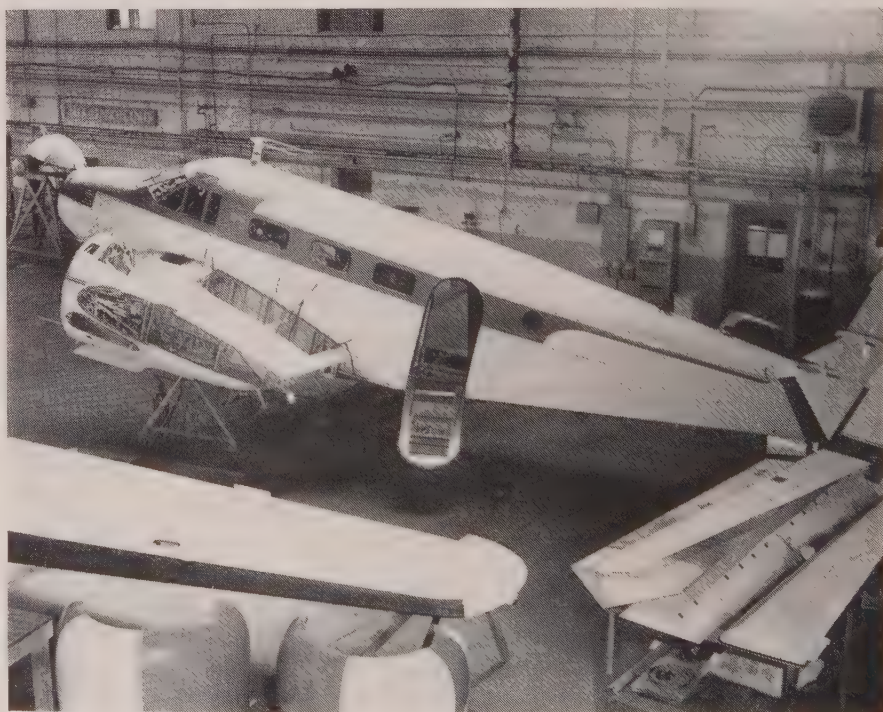
procedure for proper mooring and tying down the Cessna Model 310. In this letter it was pointed out that it is important to turn the nose gear to its full limit, either right or left, if external rudder locks are not available. Doing so places the rudder bellcrank against the stop and holds it there by means of the spring tension in the nose gear steering mechanism.

Cessna Model 310—Top Wing Skin: Cracks were found developing in right top wing skin just below the diffuser on the outboard augments tube. Cracks extend parallel to the rear spar and about $\frac{1}{4}$ " forward of the rivets holding the wing skin to the spar. This failure was attributed to an extremely rough propeller. Repairs were made to the skin and the propeller balanced.

Cessna Model 310—Firewall: A crack was found in firewall, 5" below outboard augments tube.

The Cessna Company has advised that a Service Letter is in process stating that doublers will be supplied to the field, at no charge, to reinforce the one area on the firewall which has been reported as cracking.

(Continued on page 48)



MAINTENANCE HANGAR at Butler Aviation, one of the first organizations devoted exclusively to business aircraft. A Beechcraft distributor, Butler recently introduced the most complete 1000-hour inspection in the Chicago area. Inspection includes X-ray examination of wing attach bolts and fittings, landing gear attach bolts, drag legs and magnafluxing of landing gear cluster and tail wheel assembly. Butler has since expanded to Washington National Airport, LaGuardia, Meigs Field and Lakefront, Chicago.



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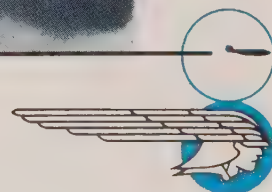
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MEMBER:
National Business Aircraft Association



Program for the N.B.A.A. 9th Annual Forum Miami, October 23, 24, 25

Tuesday, October 23

8:30 AM to 7:30 PM McAllister Hotel, Sun Room, *Registration*
2:00 PM to 5:00 PM McAllister Hotel, Flagler Room, *Annual Membership Meeting*.
6:30 PM to 7:30 PM McAllister Mezzanine, "*First Niter*" Hospitality Hour; Welcoming Addresses by Mayor Randall W. Christmas and Henry W. Boggess, President, NBAA.

Wednesday, October 24

7:30 AM to 9:00 AM Top o' the Columbus Hotel, "*Sunrise Breakfast*"
8:30 AM to 7:30 PM McAllister Hotel, Sun Room, *Registration*
9:00 AM to 10:00 AM McAllister Hotel, Biscayne Room, *DC-3 Panel*. Columbus Hotel, Santa Maria Room, *PV-1, Super Ventura, B-23, Convair Panel*
McAllister Hotel, Flagler Room, *Light Twin Panel*
9:30 AM to 3:00 PM *Ladies' Special Program*: A. Viscaya visit (busses leave McAllister at 9:30 AM). B. Luncheon, Riviera Country Club (busses return to McAllister at 3 PM).
10:45 AM to 12:15 PM Columbus Hotel, Santa Maria Room, *Lode-star-Learstar Panel*
McAllister Hotel, Biscayne Room, *Twin Beech Panel*
12:30 PM to 1:45 PM Bayfront Auditorium, "*Get Acquainted*" Luncheon. Toastmaster: Joseph B. Burns, NBAA Board Member. Distinguished Speaker: the Hon. Louis S. Rothschild, Under Secretary of Commerce for Transportation.
2:00 PM to 3:15 PM McAllister Hotel, Flagler Room, "*Airways Traffic Control*" meeting
3:35 PM to 5:00 PM McAllister Hotel, Flagler Room, *Radio and Communications Panel*
Roney-Plaza, Miami Beach, Hotel Gardens, "*Florida Fun Night*"
5:10 PM to 11:00 PM

Thursday, October 25

8:30 AM to 7:30 PM McAllister Hotel, Sun Room, *Registration*
9:00 AM to 10:30 AM McAllister Hotel, Flagler Room, *Pratt and Whitney Engine Forum*
Columbus Hotel, Pan American Room, *Lycoming Engine Forum*
10:00 AM *Ladies' Special Program*: "Past-time" Boat Trip.
10:30 AM to 10:45 AM Coffee Break
10:45 AM to 12:00 McAllister Hotel, Flagler Room, *Wright Engine Forum*
Columbus Hotel, Pan American Room, *Continental Engine Forum*
12:15 PM to 1:30 PM Bayfront Auditorium, *NBAA Annual Awards Luncheon*. Toastmaster: the Hon. Joseph P. Adams, Vice Chairman, Civil Aeronautics Board.
1:45 PM to 3:00 PM McAllister Hotel, Flagler Room, *Radar Forum*
3:00 PM to 3:15 PM Coffee Break
3:15 PM to 5:00 PM McAllister Hotel, Flagler Room, "*Looking Ahead*" meeting: Airframe, Engines, Radio, Airways, Airports, Radar, ATC
6:30 PM to 7:45 PM Bayfront Auditorium, *NBAA Annual Hospitality Hour*
7:50 PM Bayfront Auditorium, doors open to banquet hall
8:00 PM to 10:15 PM Bayfront Auditorium, *NBAA Annual Banquet and Honors Night*. Presiding: Henry W. Boggess, President, NBAA. Toastmaster: Joseph T. Geuting Jr., Manager, Utility Airplane Council, A.I.A. Distinguished Speaker: George A. Halpin, Vice President, Executive Committee, Minnesota Mining & Mfg. Co.



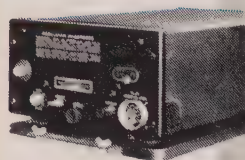
AT THE NBAA MIAMI FORUM (clockwise): Alan Baskin, Chairman, Miami Arrangements Committee; William K. Lawton, Executive Director, NBAA; Mrs. Ruth Knott, Secretary, Miami Arrangements Committee; Larry Mansfield, Accommodations, Convention Bureau; Henry W. Boggess, President,

NBAA; Mrs. Isabel McKay, Chairman, Entertainment Committee; R. W. Vestal, Treasurer, Miami Arrangements Committee; Cole H. Morrow, Board Member, NBAA; Mrs. Lois Henry, Publisher of SKYWAYS; Robert C. Sprague, Jr., Board Member, NBAA; Gerard W. Eger, Treasurer and

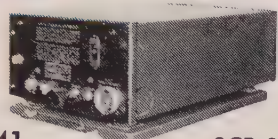
Board Member, NBAA; Ray Smith, Chairman, Public Relations Committee; K. E. Benson, Chairman, Exhibits Committee; J. E. Oyer, Member, Travel-Transportation Committee; R. Stuart Skidmore, Chairman, Program Committee; and Miss "C. M." Cearnall, Secretary to Mr. Lawton.



1945 MN-62



1944 AN/ARN-7



1941

SCR-269

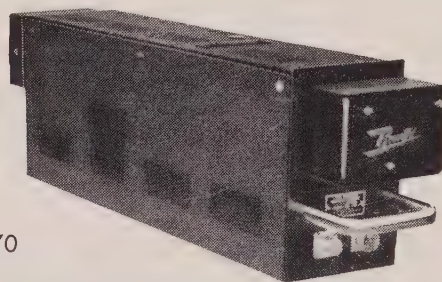


1940

MN-26/MN-31

Bendix

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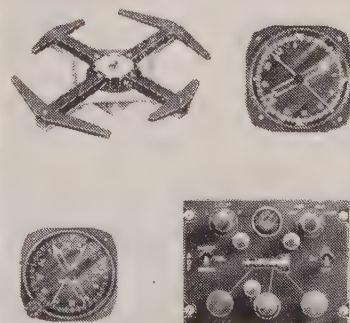
Here's another big advance in automatic direction finders from Bendix . . . the all-new DFA-70 system. It provides greater accuracy and higher sensitivity that make possible ± 2 degrees bearing accuracy with input signals as low as 12.5 microvolts.

Only $\frac{1}{2}$ ATR, the DFA-70 utilizes sub-chassis construction for simplified maintenance. Electrical tuning with digital indication eliminates tach shafts and permits the control panels to be located as far as 50 feet from receiver. Sense lines up to 35 feet can be used or up to 60 feet with slight modification. Other outstanding features include narrow-band Consol reception, ARINC Class I ruggedized

tubes throughout, and new circuitry that minimizes precipitation static.

Bendix ADF has been the "standard of the industry" since radio direction finder equipment was first introduced. From the MN-26/MN-31 to our present DFA-70 system, Bendix has pioneered and developed most of the advancements in automatic direction finding navigation systems.

For complete information and specifications about DFA-70, write Bendix Radio, Aviation Electronic Products, Baltimore 4, Maryland. Or contact: West Coast—Bendix Radio, 10500 Magnolia Boulevard, North Hollywood, California; Export—Bendix International, 205 East 42nd Street, New York 17, New York.



DFA-70 components (clockwise from upper right): MN-72 Radio Magnetic Indicator, CNA-70 Control Panel, MN-58 Dual Azimuth Indicator, LPA-70 Flush Loop Antenna.

Bendix Radio Division



Cessna 172 for 1957 has Popular "Land-o-matic" Gear

Cessna Aircraft Co. has announced the 1957 Model 172 business plane, which features the "Land-O-Matic" tri-cycle gear, extra-large flaps, and exceptional visibility for the pilot.

The "Land-O-Matic" gear represents an effort to simplify landing and taxiing procedure by providing a wide tread, low center of gravity and easy steerability. The new gear also permits operation from fields or unsurfaced runways.

Standard equipment on the 172 also includes "Para-Lift" flaps, which permit slow descent and reduces the speed of landing approaches. They also allow operation in and out of small fields.

In a landing approach with full flaps, the Cessna can be decelerated so that its descent is "twice as slow as a man in a fully opened parachute."

Other features of the 172 are a full-vision windshield that provides more than 1200 square inches of visibility, and a heating and ventilating system with six cabin outlets and a windshield defroster.



Powered by a 145 horsepower six cylinder Continental O-300-A engine, the Cessna 172 has a maximum sea level speed of 135 mph and a maximum recommended cruise speed of 124 mph.

Range at maximum recommended cruise is 519 miles, or 4.2 hours at a true airspeed of 124 mph. Maximum range is 620 miles at 7500 feet at a true airspeed of 97 mph.

Sea level rate of climb is 660 fpm; service ceiling, 13,300 feet. Gross weight is 2200 pounds; empty weight 1260 pounds; fuel capacity 42 U.S. gallons.

Span, 36 feet; length, 25 feet; wing loading, 12.6 pounds per square foot; power loading, 15.2 pounds per horsepower.

The Cessna 172 is readily convertible from passenger to cargo carrier. A luggage compartment behind the rear seat will accommodate about 120 pounds, and is readily accessible on the ground or in flight.

The plane will carry about a quarter ton of cargo. Two wide 36-inch doors facilitate the boarding of passengers or cargo.

The 1957 Cessna 172 will deliver for \$8975 f.o.b. Wichita.

Plymouth Oil Co. has First Learstar Mark II

The first Learstar Mark II, a conversion incorporating most of the Mark I performance gains at 40% less cost, is in operation for NBAA member Plymouth Oil Co., Pittsburgh.

Like the Mark I, the Mark II is a conversion of the Lockheed Lodestar to obtain increased performance. Ready CAA certification is anticipated, since the CAA has already accepted the flight characteristics of the Mark I, and its demands are based entirely on the performance figures, which are dependent on the different engines in the Mk. II.

The principal differences between the Learstars I and II may be summarized as follows:

The basic weight of the Mk. II is 14,900 lb., compared with 15,700 lb. for the Mk. I, and carries a payload of 7600 lb., 700 pounds less than the Mk. I. The Mk. II carries 933.3 gallons of fuel against Mk. I's 1050 gallons, with a range, respectively, of 2339 and 2667 miles. Airspeed at 108 gallons per hour, the normal cruising speed for the Mk. II, is only slightly less than that of the Mk. I: 272 mph compared with 275 mph.

The modification of the Lodestar to Learstar configuration incorporates changes in the wing panels, nacelles, nose section, tail, antennas and flaps.

Changes in the wing include structural modification forward of the spar, installation of new high-speed de-icers, fiber-glass wing tips, stall warning system and reworking of fuel, oil, mechanical and electrical system.

Nacelle modifications included new cowling, engine mounts, exhaust stacks, firewall, oil cooler and carburetor heater. The landing gear is modified with new well doors and retracting mechanism, new wheels and brakes, fire detecting system, and an auto-feathering system.

The new nose section has horizontal pilot masts and flush-mounted taxi-lights. A 100,000 BTU Janitrol heater is installed in No. 1 baggage compartment. Lear weather radar is optional.

The angle of incidence of the tail is changed, and spring tabs are installed on the elevators and rudders. The whole empennage is reinforced, and a retractable tail wheel is installed.

The installed radio is reworked to conform to Mark II specifications, and ADF, glide path and marker beacon are installed flush. Omni antennas are mounted on the vertical fin.

The flaps are modified to extend the trailing edge of the wing.

The conversion of the Lodestar to Mark II configuration costs about \$175,000, and gives the following performance characteristics: top speed, 290 mph at 10,000 feet; climb rate from sea-level, 1250 feet per minute on two engines, 400 feet per minute on one engine.

The second Mark II Learstar is on order for the Warren Oil Co., Tulsa.

Aero Commander Now has Hartzell Reversible Full-Feather Props

The use of the first reversible propellers for business aircraft is being investigated by Aero Design and Engineering Co. for use on the Aero Commander. The full-feathering, reversible three-bladed propeller is model HC83F-3A, produced by Hartzell Propeller, Inc.

The Hartzell reversible propeller will increase the utility of the Aero Commander by increasing the safety of operation into short fields and by aiding in braking on wet or icy runways. It is estimated that a 90 mph velocity of the Commander at 6000 lb. gross can be decelerated in about 400 feet.

Reversing is controlled electrically on the Commander to give easy, positive action. To reverse upon landing, the throttles are closed and then both reverse switches are actuated, which causes reversing to occur immediately as the throttles are opened. The blades move into a reverse position of -25°.

The design of the mechanism makes it impossible to reverse propellers until the throttles are closed and the plane is on the ground.

(Continued on page 76)



FIRST Learstar Mark II, operated by NBAA member Plymouth Oil Co. Mark II conversion gives executive Lodestars 270-290 mph cruising speed, 22,500 pound gross weight.



VASCO N. DE BALBOA



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Pilots no longer have to perform mental computations to determine the exact headings required to intercept and fly a desired VOR radial or runway localizer. ARC's CD-1 Course Director, now in use in hundreds of aircraft, relieves the pilot of these problems and gives him time to concentrate on others at this critical period.

With ARC's CD-1 the pilot merely (1) selects his VOR or localizer station, (2) sets his Course Director to the bearing of the desired VOR radial or localizer, (3) turns his aircraft until the vertical needle of the cross-pointer meter is centered, and (4) continues to fly

the aircraft, keeping the needle centered. The aircraft will intercept the selected track quickly and smoothly and at the same time compensate exactly for wind drift. No mental computations — no overshoot with resulting zigzags to bracket the desired course.

This useful and reliable equipment adds only 10 pounds to your aircraft. Ask your ARC dealer to install the CD-1, along with a dual installation of ARC's Type 15D VOR Equipment. The ease and precision with which you can then fly VOR and Localizers will be a revelation — and incidentally good insurance.

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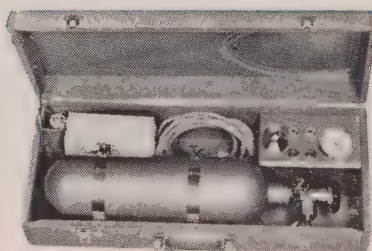
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ROTATING BEACON

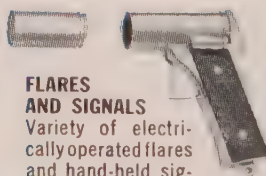
Vital safety device for night flying. Casts two beams (1,000 and 4,000 candlepower) which can be seen 40 miles or more.



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Maintenance

(Continued from page 42)

Cessna Model 310—Nose Gear Bellcrank P/N-0842103-1: A recent accident occurred on landing attributed to the nose gear failing to lock in the down position. Further investigation disclosed nose gear bellcrack cracked in two, resulting in the gear hanging in the down position without locking. Cessna Service Letter 310-6 dated April 17, 1956, covers a modification on the nose gear bellcrank. Parts were supplied to the field at no charge, along with a labor allowance and a bonus. Cessna urges compliance.

Douglas Model DC-3 (P&W-R-1830-75)—Magneto SF14LN-8: An inspection subsequent to failure of the left magneto disclosed distributor rotor was loose on splined shaft and was removed from shaft by turning rotor without loosening retaining nut. The splines were so badly worn that it was possible to turn the rotor on the shaft. Further inspection revealed the cam shaft support bearings were worn to a degree of affecting the points. Cover plates were removed from the remaining three magnetos, which were found in a similar condition in reference to movement in the cam.

Douglas Model DC-3—Potential Fire Hazard: Returned after take-off on account of odor of burning insulation and smoke in cockpit. Inspection found screw out of back of voltmeter, allowing plate on back of voltmeter to contact plus terminal, causing direct short. Wire from plus terminal to voltmeter selector switch burned through and insulation on wire from selector switch to right generator shunt charred.

Two Component Checks For DC-3

CAA has issued two maintenance bulletins of interest to DC-3 operators.

The first concerns the marketing of tail-wheel axles which are improperly fabricated and not identifiable by part numbers. The axle shaft head of the substandard component is fastened with soft solder to the shaft. The standard component has integrally manufactured head and threads.

The subject of the second bulletin is unapproved four-way engine, flap and landing gear hydraulic selector valves. A recent investigation of a malfunctioning valve disclosed that the valve was an unapproved component in which the valve selector shaft retainer ring was made of brass, and oversize to the extent that it did not lock the selector shaft as intended. The questionable valves have no manufacturer's identification marking.

Seabee Maintenance Company

Announcement has been made of the formation of American Aviation Corp., organized to continue services and the supply of spare parts for the RC-3 "Seabee." These activities were formerly conducted by J. K. Downer, who purchased the manufacturing rights to the Seabee from Republic Aviation.

(Continued on page 68)

safety exchange

A clearinghouse of practical information on recent developments affecting flight safety. This will include factual accounts and analyses of actual, in-flight occurrences (near misses, unusual in-flight experiences, conflicting traffic clearances, and other incidents of non-routine nature. In addition, CAA, CAB reports and other sources will be briefed.

Ralph Piper, Chief Pilot, Monsanto Chemical Co., St. Louis, is NBAA co-ordinator of the Safety Exchange. Readers are urged to advise Mr. Piper of all ideas which may contribute to the safety of business aviation. Address him c/o SKYWAYS to Business, 122 East 42nd Street, New York 17.

CAB Imposes IFR Rating Recheck On Exec Pilot

In an alleged violation proceeding filled with evidence of reasonable understanding and competent analysis, the CAB rejected a 30-day suspension recommendation of their own examiner and called instead for a competency recheck of an exec pilot's IFR rating.

The case involved a B-23 pilot on instruments in the congested DETROIT area who for some reason was unable to locate an assigned radio fix on his charts in order to comply with a holding instruction of ATC. After again reporting his inability to comply with an alternate holding issued, he missed a second alternate holding instruction and concentrated on definitely establishing his position.

By the time this was accomplished, he reported himself over a radio facility that was being employed by another aircraft at the same altitude and a very close near-collision occurred. In consideration of the known complexities of the situation, the Board found that there was no intentional willful disregard of safety standards or procedures warranting a punitive suspension of certificate, but rather a question of competency suggesting the rating recheck.

Pilot Suspension For Failure To Follow Missed Approach Procedures

In a Supplemental Opinion and Order on Reconsideration, the CAB recently suspended a scheduled airline pilot's ATR rating for 10 days for failure to follow the prescribed missed approach procedure at the GREATER PITTSBURGH Airport.

1. After having aborted a landing on Runway 28 of the GREATER PITTSBURGH Airport, the pilot of a DC-6B failed to follow the prescribed missed approach procedure which required a

climb straight ahead to a holding position at the Clinton radio marker. Instead, he made about a 180° turn (with the diameter of the arc of turn being about 1½ to 2 miles) to the left, flying until southeast of the airport where a right turn was made.

During this time, the traffic controller attempted to make radio contact with the pilot without success for a two-minute period, and to avoid the possibility of a collision, the traffic controller diverted a Capital Airlines aircraft which had been cleared to land after the DC-6B. The findings, as outlined above, were based primarily upon the testimony of the radar operator at the GREATER PITTSBURGH Airport.

2. The pilot stated that he had adopted a course different than the established missed approach procedure in order to avoid another aircraft in the Clinton vicinity. He conceded that his testimony and that of the radar operator were in "irreconcilable conflict" and questioned the credibility of the operator's testimony.

However, the Board noted, in rejecting the pilot's testimony in favor of the operator, that a recording of the two-way radio contacts revealed that the pilot explained the unorthodox maneuver at the time as an effort to regain visual contact with the field, and made no mention of any other reason.

The Board originally felt that the finding of a violation against the pilot constituted a sufficient censure. On reconsideration, it agreed with the CAA attorneys that in view of the current concern with air safety, a decision to not press this action because of its being the "first detected violation" on the part of a pilot would constitute a dangerous precedent, and a loss of the deterrent value of the proceedings.

Crowded 126.7mc Channel Demands Relief

The CAA is NOTAM'izing through the AIRGUIDE a suggestion to all airways users that they request INSACs to reply on the associated VHF navigational voice facility to relieve jamming on 126.7 mc. Capt. Ralph Piper of Monsanto Chemical Co., NBAA's Chairman of the Committee on Flight Operations points out that, to make the air-to-ground call on 126.7 will compound the trouble inasmuch as the pilot will not be able to time his call to avoid even worse congestion for other users of 126.7. He suggests, in event 126.7 channel is overly busy, avoid it entirely, call on 122.1mc and request reply on 122.2mc, the alternate INSAC common channel.

CAA To Modify Airport Radar For Improved Performance In Storms

A 47-city CAA program to get a better radar picture of aircraft flying in snow and rain has been announced by James T. Pyle, Acting Administrator of the Civil Aeronautics Administration.

Under the program CAA will "circular polarize" a total of 47 airport surveillance radar (ASR) installations, either at existing locations or prior to installation of the equipment at new sites.

Circular polarization changes the method of polarization from vertical or horizontal to an omnidirectional combination of both. This permits the radar to "see" aircraft passing through rain and snow and present a clear return of the aircraft on the radar screen. At the present time aircraft operating in storm areas often fail to show on the radar scope.

Of the 47 ASR's in the program for circular polarization, the one at LaGuardia airport was completed in June. Five others, at Idlewild, Newark, Boston, Washington and Chicago (O'Hare) have been contracted for and will be completed by the end of the year.

Three types of ASR radar are involved in the program, the ASR-3, which is the latest type in CAA use, and the ASR-2 and the ASR-1's which were installed under prior programs. Average cost to circular polarize new ASR's prior to installation is \$5,000 and for equipment already in place, \$15,400.

Louisville Radar Control Procedures Instituted

Commencing in October, STANDIFORD Approach Control instituted radar control of inbound traffic arriving both STANDIFORD and BOWMAN Fields. Actually navigation will be accomplished by the pilot through the use of established radio nav aids, unless radar vectors are provided at request of either the pilot or the controller. Standard radar separation will be applied not only between successive arrivals to either airport, but also between these aircraft and enroute low Altitude Control aircraft in the latter area which encompasses an irregularly shaped area cutting the airways in an approximate 40 mile radius except in the direction of the Godman AFB Restricted Area.

Standard ANC (non-radar) separation will be provided successive departures from both airports.

(Submitted by Capt. K. Jolly, DC-3 N 40TG, Texas Gas Transmission Corp., NBAA rep. Louisville area.)



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Collins Develops Proximity Warning Indicator

Collins Radio Co., Cedar Rapids, Iowa has developed a proximity warning device which will give the pilot of a plane an aural and visual warning of any object within two miles of his plane, and tell the pilot the direction in which the object lies.

Although intended for airlines, the \$12,000, 125-pound unit is good news to business pilots as well, since the new device will make the presence of a business plane known to the high-speed traffic of high-density areas.

The Collins device, although similar to radar in operation, does not require continuous surveillance. Equipped with six stationary antenna, the device will sound an alarm and flash lights indicating the direction from which another plane is approaching. The proximity warning may finally be connected to the auto-pilot, so that the avoidance turn is begun automatically. The direction indicator, however, will not appear until 1959, a year after the initial installation, because of the complexity of the computers necessary to correlate the position, speed and heading of the two planes to determine if they are on collision course.

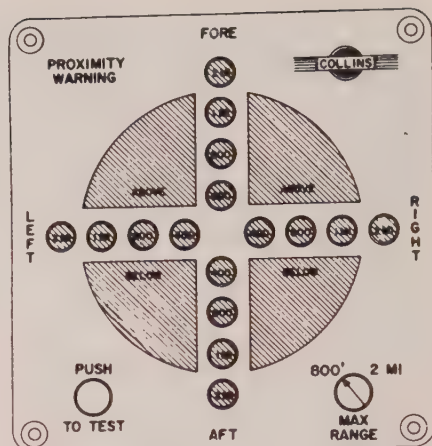
The Collins equipment will probably have warning lights arranged in a cross-shape, with four warning blinkers on each arm to indicate the direction of the intruding aircraft (ahead, behind, left or right). The cross lights will indicate horizontal proximity varying from two miles to 400 feet. A bullseye in the center of the cross will contain lights to indicate approach from above or below from distances between 800 and 400 feet. An audible alarm will call the pilot's attention to the warning lights.

The Collins proximity warning will also react to the presence of mountains—in fact, any object larger than forty square feet. The only disadvantage to the system is that a bank at relatively low altitude will result in a warning when the antenna on the low wing sends its signals against the ground. The only solution envisioned for this particular problem is that the pilot will learn to recognize such false alarms.

Development of the device was stimulated by the Air Transport Association, which, in a 1955 survey, disclosed that airliners averaged four near-misses daily.

ATA anticipates that the Collins device will cut collision hazard by 95%. A foolproof ground control system is not in the near future, but the Collins system represents a big step in the right direction.

A special airlines committee has announced that the proposed Collins proximity warning equipment for aircraft has been deemed by the committee as the most satisfactory of proposals developed so far after taking all factors into consideration, according to Milton W. Arnold, Vice President—Operations and Engineering of the Air Transport Association.

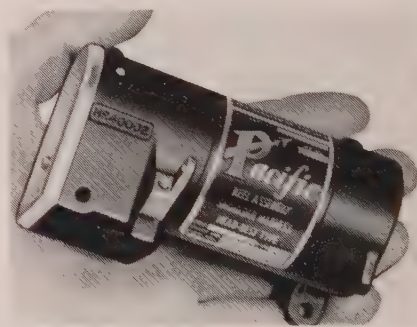


Shoulder Harnesses Make the Difference Only When Used

Two recent accidents emphasized not only the value of shoulder harnesses but the folly of ignoring them when available. Both aircraft were so equipped.

In one accident, the pilot and passenger disdained this safety feature and let it dangle down the backs of their seats. They died from head injuries received when they hit the instrument panel.

The second couple were using their shoulder harness and emerged without a scratch although the aircraft hit on the nose and flipped over. For takeoff and landing there can be no argument against the shoulder belt even if of the type that requires a few moments of effort to adjust seat belt slack, common of light aircraft, single and twin.



In the medium and heavy twins most used as executive aircraft, an entirely new shoulder harness reel, designed by Pacific Scientific Co., of Los Angeles, features multi-directional safety action, in an unusually light, compact unit, mounted shoulder harness on the pilot's head rest or behind the seat back on a bulkhead or support.

Weighing just one pound, the automatic HR-40 Reel locks with split-second timing when occupant moves in excess of 2Gs. Allowing full mobility and freedom of pilot movement below this rate, it will withstand a minimum load of 4000 at any point of strap extension! Release is simple, with a flick of the control lever unlocking the reel and restoring it to "automatic."

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Every day, all over the world, Bell helicopters are flying more hours than all other types of helicopters combined. These rotorcraft are performing dozens of different jobs which can not be accomplished by any other vehicle.

For instance, Chicago Helicopter Airways Inc. has just completed its seventh consecutive year of flying airmail in the metropolitan area and its suburbs. CHA's fleet of Bell Model 47 helicopters has flown more than 45,000 accident-free hours, has traveled 2,250,000 miles in delivering over 20,000,000 pounds of mail.

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copters are rendering commercial and military operators in 38 different countries. And it is the only aerial vehicle whose performance is measured on a doorstep-to-doorstep basis.

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Accident Report

Vancouver, Wash. Accident involved a Taylorcraft with pilot and one passenger; pilot seriously injured, passenger killed.

The pilot, with his wife as passenger, planned to fly to undeveloped areas of Idaho, but first turned westward to La Grande for fuel. In the course of this leg of his flight the pilot turned into a narrow dead-end valley, where the crash occurred in tall timber opposite Red's Wallowa Horse Ranch.

"According to experienced airmen who participated in the search and rescue operation, there is strong evidence to support the theory that the Taylorcraft stalled out in the turn [at the end of the valley]. In the resultant crash that took his wife's life, [the pilot] suffered two broken ankles and kneecaps, along with numerous bruises.

"Because [the pilot] was not on a flight plan, it was four days before the State Board of Aeronautics Search and Rescue organization was alerted. Search groups were organized under the supervision of Ray Dunsmore and Eldon Down."

The searchers were virtually without leads until a LaGrande pilot, Norm Daniels, fishing in the Minam River, reported having seen the Taylorcraft fly down the river. He said it sounded as though it had crashed in the opposite canyon. Pilots Voetburg and Draper, in one of two aircraft participating in the search subsequently spotted the smoke from a fire which turned out to have been set by the crashed pilot. Because the country was timberland, the Taylorcraft was invisible, and the fire was reported to the U. S. Forest Service.

"The Forest Service dropped three smoke jumpers, who remained with [the pilot] through the night. In the meantime, a ground party composed of members of the Wallowa Mountain Rescue Team and other volunteers under the direction of Arlen Chenuault from the U. S. Forest Station at Union, packed in to the crash site. They arrived at 2:30 AM. At daylight the party carried the pilot one and one-half miles downhill, where they were met by a wrangler and his horse from Red's Ranch. [The pilot] was placed on the horse, and he rode it to the ranch, arriving at 11:30 AM. A doctor flown into the ranch examined [the pilot], who was then flown out to LaGrande by Down."

How Not to Do It: Wrong Cables on Wrong Pulleys

A report comes from the State of Nebraska Dept. of Aeronautics about a plane on which both ailerons go down when the control wheel is turned full left, and both go up when the wheel is turned full right.

The pilot—not a Nebraska man, according to other Nebraska men—actually flew his plane in this condition, and made a belly landing right after take-off.

It all started when the pilot removed the left wing panel to repair a leak in the left gas tank. When he reinstalled the wing he ran the cables over the wrong pulleys, and then neglected to check aileron action after repairs or before take-off.

Nebraska advises this pilot to stop flying; so do we.

Static Fatigue in Pilots: What Causes it— How to Prevent it.

Static fatigue—getting tired *because* of inactivity—is a real problem in flight safety, but it receives little attention because it is hard to define when you don't have it and hard to recognize when you do.

Flight Safety, Inc., defines static fatigue in terms of its causes:

1. Lack of adequate preflight rest (which is aggravated by long "time-out-of-bed" prior to flight)
2. Inadequate in-flight rest
3. Minimum physical activity, which reduces circulation, metabolism, etc.
4. Prolonged exposure to a very dry atmosphere, such as that of pressurized aircraft
5. Loss of salt without replacement (this results principally through perspiration)
6. Prolonged exposure to relatively low oxygen tension, producing a mild form of hypoxia.
7. Prolonged exposure to noise and vibration, such as that of reciprocating engines.

The static fatigue which may result from various combinations of these factors may make you drowsy, inattentive and indifferent to what is going on around you, and slow to react when the situation changes rapidly.

The Cambridge Cockpit Studies indicate that psychological tension contributes importantly to pilot fatigue. The efficient pilot is in a continuous state of concentration on controls, and is continually on the lookout for potential hazards. The cumulative result of prolonged concentration and anticipation of hazards is fatigue. If the pilot is worried or preoccupied for any reason, such as family of financial problems, he will experience fatigue sooner than the pilot who has only the routine in-flight problems to overcome. Thus, the fact that a pilot does not exert himself physically in flying is not a redeeming factor but, as Flight Safety points out, tends to aggravate his problem through physical debilitation.

Flight Safety suggests some of the following means of avoiding or relieving flight fatigue:

1. Adequate pre-flight rest
2. Minimum "time-out-of-bed" prior to flight; hard to control, but it can be minimized by improving operation techniques
3. Scheduled in-flight rest periods in multi-place aircraft, dependent on crew discipline. Flight Safety reports that the best in-flight rest is obtained

in properly suspended hammocks, which afford good vibration insulation.

4. Exercise of the "antagonistic muscle" type, for example, "placing the fist of one hand into the palm of the other and pushing while resisting the push with the open hand," or alternately flexing thigh muscles, etc.

5. Ample fluid intake, particularly of non-diuretic liquids like water, milk and canned fruit and vegetable juices, rather than tea or coffee.

6. Eating light but often. The digestion of a full meal accentuates the effects of fatigue.

7. Breathe 100% oxygen for several four- or five-minute intervals during the last 30 or 45 minutes of a flight.

8. Don't use drugs unless for an all-out mission, and then only with medical supervision.

One final "don't", from the Cambridge studies, is: don't take any worries into the cockpit with you. This is especially relevant to the businessman-pilot, who more than any other type of pilot is likely to let business considerations take his mind off the immediate problem of keeping himself safe in the air and in landing.

English is Aviation's International Language

One contribution of aviation which has come unexpectedly, but which should certainly have commercial and technical value, is the fact that the aviation lead of English-speaking countries has made English the international aviation language. Among the many standards already adopted by the 57 member nations of the International Civil Aviation Organization is the use of English in airways traffic control centers, and airport traffic control towers.

Robert Green, CAA airways and airport specialist, recently returned from Thailand, cites the use of English in overseas ATC centers as further evidence of the value of standardized methods. Although he remarks that an English exchange between an Air France pilot and a Siamese controller is quite an experience, the fact that "You can count on an hour or less of time spent on the ground at each terminal, instead of as much as three hours not long ago," is "a testimonial to the value of standards in world aviation."

Dry Chemical Fire Extinguisher

A compact automatic dry chemical fire extinguishing system for inflammable liquid and electrical fire hazards has been developed by Ansul Chemical Co. The PS-30 unit can be operated either manually or automatically. Automatic operation occurs when fire-heat melts a fusible metal link.

The PS-30 system consists of a 30-pound capacity dry chemical reservoir installed near the hazard. A CO₂ cartridge expels the dry chemical through piping from the tank to the hazard.

Emergency—Now What?

(Continued from page 19)

until he realizes what's going on."

Skyways: What about the case of the engine fire you mentioned?

Mike: "It's not only a question of realism as far as simulation goes, but a problem in decision and coordination. If the pilot is in the stack at, say, 5000 feet, he has a limited amount of time to decide what to do—declare an emergency with ATC, set up his radios, and get on the ground in the prescribed time. You'd warp all the valves if you did it the way it ought to be done in an airplane."

Skyways: What's the time limit?

Mike: "We went back through the records of aircraft fires, and came up with a figure based on experience. If the pilot doesn't make it in time I kid him a little bit, and hand him my discount card at the local florist. Don't spoil my fun."

Skyways: To get back to the original question, are you replacing the airplane with the Translator?

Mike: "Very definitely not. I merely mentioned several things which the airplane can't do normally. There will always be a need for the aircraft for certain training maneuvers—principally for those requiring visual reference to the ground. I'd say 50-50 would be about the right ratio."

Skyways: What good do you believe the crews get out of the Translator?

Mike: "I'd say considerable—you can't make a general statement because of different experience levels. Some do very well—others need the training quite badly. We've had perhaps 70 crews go through the trainer—I know the copilots are getting a tremendous amount of good out of it."

Skyways: Why the copilots?

Mike: "The better way of putting it is improvement in teamwork. Some of these emergencies are more than one man can handle, and if the pilot is not making full use of his copilot it shows up right away. The automatic radio is also a big help—it makes the copilot actually tune the transmitter and ADF. He's supposed to be flying an actual airplane—we see that he does."

Skyways: How many hours of training do the crews get, and how long are they in the Translator at one time?

Mike: "Most of the companies contracted for 12 hours a year. Some split the time into two 3-hour periods twice a year—other pilots want to take the entire 12 hours the first week. We're learning from experience, of course. Based on pilot comment, I'd say the best way would be to take the 12 hours as an initial course, followed by 6 hours every six months. In other words, take an extra six hours the first year. Some of the pilots have gone back to their companies and requested this. We limit flights to three hours each due to the fatigue factor."

Skyways: What do the crews say about the Translator after they finish?

Mike: "I think the best comment I could make on that would be to say that they all want more. When a man shakes my hand and says, 'Thanks, Mike—I appreciate it,' I feel I've done a good job—you can tell when he means it."

Skyways: Mike, I noticed you mentioned the airlines a moment ago—do you really believe you can compare training theories of airlines with the needs of business aviation? Don't you believe there is a vast difference in the operations?

Mike: "Certainly—but only in some respects. Equipment needs, maintenance

procedures, and the number of people helping you are quite different—but when it comes right down to safety—how and when to bend the throttle, I say hogwash. It doesn't make any difference whether the uniform is airlines, Air Force, or a private company—an airplane is an airplane—the same ATC instructions apply to both, and the weather is the same. The only difference I know of is in the pilot's head—and you can't classify what a man knows by his uniform or lack of one. I respect headwork—no matter how you slice it—we all need training on this stuff."



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Round Table

(Continued from page 28)

Eichem: "We made a survey in Region Three, and from Detroit, Chicago, Minneapolis and Wichita, our present agents are scheduled from one to two weeks ahead on personal inspection, mainly because of expired certificates."

Barclay: "I checked on that at the district office in Virginia, to see what sort of backlog they were building up, Les, and they were about three weeks behind. A good share of their appointment workload, probably 50%, is for inspection of repairs and alterations. So, I wondered what the set-up was on that. As long as the airworthiness certificate has not expired, can it be taken care of without CAA inspection?"

Eichem: "Any mechanic with an inspection authorization, or a CAA agent, could return the aircraft to service."

Barclay: "Dee Howard, do you have anything to offer on this?"

D. U. Howard (President, Howard Aero, Inc.): "Our maintenance operation has been similar to that described. One of the things that has needed clarification from time to time in these discussions has been the difference in the interpretation of progressive maintenance. Now, for years we've all been accustomed to get along with the routine maintenance that was required every 100 hours on an aircraft by doing various repairs on the airplane that we knew would have to be accomplished by the time the airplane was up for an annual. When it came up for the annual, it had the minimum down time. Also, the system of running a 100-hour inspection not only in connection with the annual, but the routine 100 that is arbitrarily pulled by most good operations, where you do the engines before one trip, and the airplane after the next one, and so on down the line.

"A great number of people who protested at the time of the original draft release were expecting a type of progressive maintenance unlike that of the airlines, or unlike that which we call progressive maintenance, where you never have to reach an expiration date, or never reach the period of an annual when your airplane has to come down, not knowing that the airline system of progressive maintenance is more complicated than just keeping an airplane airworthy, where you have longer down times. The hours of utilization on airline equipment, being much greater than executive airplanes, just doesn't allow for these long periods of down time that come in between scheduled trips for an executive operator. Most executive operators take advantage of their erratic schedule, and when they see that they have a period in which nothing is scheduled for the airplane, they go ahead and accomplish things that they know we'll have to do down the line. That has been more or less interpreted as progressive maintenance, but that type of progressive maintenance differs completely from that of

an airline where you get quite a number of hours of utilization of equipment every day, and each maintenance operation is scheduled into a particular spot in the operation. Say, for example, that you check your landing gear every 150 hours instead of every 100 hours. In airline operations, the landing gear actually gets checked right on the 150 hour mark; an executive airplane, on the other hand, may be miles from its home base.

"For that reason, as I understand their interpretation of progressive maintenance, it called for some system whereby you could guarantee that if they ran this landing gear check to the maximum time, that it would be checked at that time, like an airline does. Well, that is a cumbersome system for an executive operator to live with. As Ferrell Roberts pointed out earlier, unless he has quite a load of airplanes and a pretty good schedule similar to an airline, he just can't live with that type of system. And the big shock came when a lot of executive users, not realizing the difference, felt that they were being pushed into certified repair stations; they didn't quite understand why.

"In nearly every discussion I have had with an executive user, this has not been very clear. By now, I'm sure that it has been cleared up for most people, but that was the cause of the uproar that we heard. Now everyone has realized that the system they have been using, of keeping the airplane in good shape so that when the time comes for an annual inspection there is a minimum amount of work needed, is a pretty good one. In the beginning a lot of people thought they were going to get a progressive deal that didn't require much bookkeeping, and that they would never have an annual coming up. It just doesn't work that way."

Eichem: "With reference to what you said, for instance, on checking the landing gear every 150 hours, even if you're away from home—The regulations provide for a 5 or 10% buffer on the inspection period. In other words, you can exceed the 150 hour period by 10%, if you're away from home, and then subtract that time from your next forthcoming inspection. In addition, the regulations provide that if you are away from home, you may also engage the services of any rated A&E, and perform the progressive inspection that is due, utilizing the same forms and system as provided, and then incorporating his report, made on your forms, into your home office file on your return."

Howard: "That's a liberal way of doing it, and it does provide that they don't get caught somewhere, but it is a more cumbersome system than the one they've been using."

Eichem: "Actually it comes down to this: by regulation, in accordance with the executive operation, they are bound to perform a periodic inspection once a year, and to keep their airplane airworthy for the entire eleven or twelve months. However, if they commit them-

selves to a written progressive system, they are a little more definitely bound during those later months, than they are if they say, 'We'll keep it airworthy'. The CAA is satisfied either way, because, by surveillance, we will satisfy ourselves of the plane's airworthiness, whatever system is used."

Howard: "What I want to point out is, for the benefit of anyone who doesn't have all this straight, is that the other system really has a lot of merit for executive operations. There was a lot of misconception as to what progressive maintenance really is."

Eichem: "The progressive system lends itself to any operation in which you are concerned with down time, because, if you do a fourth of an airplane a day you can, should an emergency arrive, return it to service much more quickly than if you've got it scattered all over the hangar for a complete inspection."

Howard: "The most widely used systems, which we have discussed, is probably the one in which you simply keep your airplane in a good state of repair, so as to have a minimum of down time for the annual inspection."

Roberts: "Most executive aircraft in this country fly an average of 300 to 500 hours a year. While these planes are at home base, repairs and other work are being performed continually. Therefore, when the 100-hour inspection is due, some work is finished. By keeping records verifying previous work, a 100-hour inspection is an inspection of their airplane only, plus a few details which must be accomplished each 100 hours.

"In our business, there are many factors, such as age, that do as much harm to an airplane as flying time. Therefore, we feel that once each year a check must be made on items such as rubber fuel cells and fire extinguishing equipment, etc. Considerable time is needed to perform these checks such as once a year on the annual inspection. Generally, the annual can be combined with an engine change, or some other major equipment change, to minimize the down time.

"If you have occasion to perform major repairs to your airplane, and perform a 100-hour inspection and a complete airworthiness check at the same time, you can submit the 2350 form and be legal for another year. In fact, you can do this every 100 hours. I believe this makes the new system better."

Howard: "The only thing we run into that differs from your type of operation is the operator who has only one airplane and is based in a small town somewhere. Some of these people are inclined to let things accumulate from the last periodic. He is the one who is really in trouble from the down-time standpoint, because he's failed to keep pace with his plane."

Roberts: "Possibly we interpret this incorrectly. We say we run a modified progressive system. Perhaps we should say we run a preventive system all year.

(Continued on page 56)

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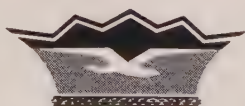
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and an annual once each year."

Howard: "That's probably a good definition of the two systems: the Preventive System and the Progressive System."

C. L. Kraemer (*Captain, American Airlines*): "Actually, there could be quite a bit of difference between progressive and preventive. With a progressive system, you could go right up to the failure point and still be legal, technically. With the preventive system, you detect anything, at any time, that may develop. I've heard many discussions on preventive versus progressive."

Howard: "The progressive system simply requires a lot more bookkeeping. The preventive is a much more common sense deal; you keep records, but

you're way ahead of the thing."

Roberts: "We believe most executive operations probably keep better records on an airplane now than the CAA would ever think of requiring. These records are for their own information rather than to prove anything. We keep records on an airplane in order to assure that various inspections, repairs, and replacements have been made. Such records are for our own information; however, if we go to progressive, we must keep records for proof to the CAA."

Howard: "Many operators are confused as to just what they're talking about."

Barclay: "We have one point to clear up; possibly I missed it. With regard

to the 150 hours on the landing gear, is that within the regulations as far as the progressive inspection is concerned?"

Howard: "It depends upon the airplane."

Barclay: "Do you mean that it depends on whether it is a commercial operation or not? I mean, specifically, the 150-hour landing-gear inspection."

Howard: "That doesn't apply to all airplanes. That figure is in accordance with the manual for that particular type of airplane. If the manual specifies check on the landing gear every 150 hours instead of every 100 hours, by all means do it. I suppose they do that in accordance with past operating history of their airplane, the way you get extension time on the engine overhaul. It may be 150 hours for one airplane, but it may be more or less for another plane, depending on the manual. Don't some of the airline airplanes go 150 hours or so on the landing gear cycle?"

Eichem: "That would be satisfactory for an airline operation, and I'm sure it's the practice in many cases, right now, to extend the period for many components beyond 100 hours. But, again, that would all depend upon the type of operation in which the airplane is engaged. If you were operating for hire, you would be bound by the 100-hour inspection and the periodic, unless you went to the progressive and through justification established an increase in your inspections. This, of course, would depend greatly on your past operations."

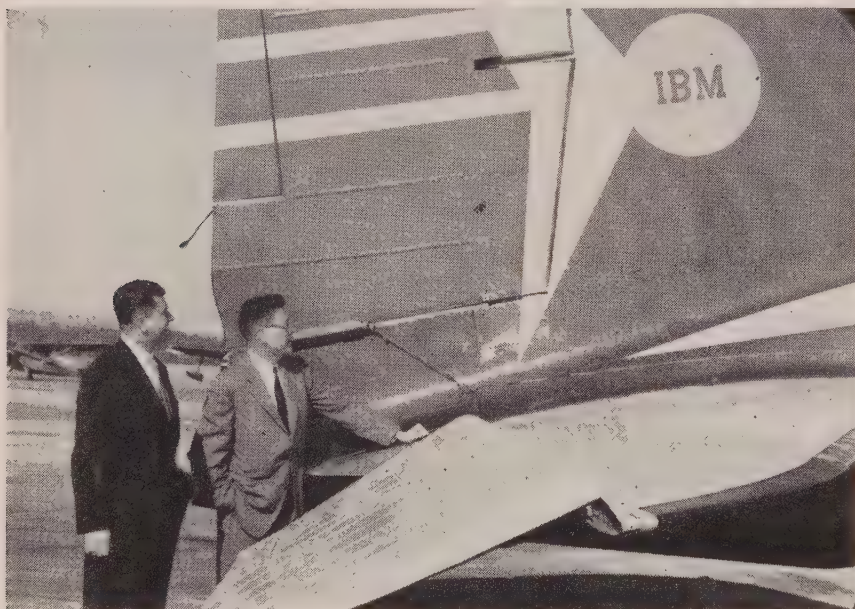
Howard: "That would be similar to the time extensions you used to get on the light aircraft engines."

Eichem: "Yes, for air taxi work and the same procedures as the airlines use in extending or increasing their periodic inspection periods."

Barclay: "Thank you, Les. Mark De Groff, you own and operate a twin-engine airplane, and do a good bit of flying every year. Will you give us your viewpoint on this?"

Mark E. DeGroff (*Pres., Medco Products Co., Tulsa, Okla.*): "I have all my maintenance done for me and this is not going to change my operations one bit. I'm a business pilot. I fly 500, and I'll probably go to 650 hours this year. As I see it, any of us who let our airworthiness certificate expire, without getting our permanent one in, are causing a hardship on CAA by our negligence. On the other hand, it wasn't our idea to make the change. Therefore I think that SKYWAYS can clear up the point. I know I wouldn't want to be on progressive maintenance to a point where I only had ten percent leeway. I went on a 40 hour and 30 minute trip two weeks ago. Had I been on that, and my 100 hour came up, I'd have had to stop in Seattle or Sacramento or someplace along the way to get my maintenance taken care of. I don't know what percentage of people I am

(Continued on page 60)



IBM Can't Afford Downtime!

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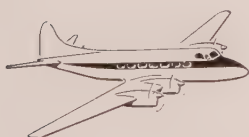
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CRADLE OF ATC

by Joe Hazelton

Most air traffic controllers since the war were recruits from the ranks of ex-G.I. pilots and traffic men, who were trained "on-the-job." The old system of hiring has become inadequate because an almost 100% increase in air traffic has made thorough training in ATC procedures essential. Where to find the men for this job is a good question; the CAA training center at Oklahoma City may be a good answer.



TRAINEE CONTROLLERS working out characteristic problems which face the pilot en route. First-hand knowledge of such problems is essential before assuming ATC responsibilities. An expanding traffic control system and the high speed and density of air traffic has caused CAA to train controllers more intensively than at any time since the war.

It is ironic that a major catastrophe of the magnitude of the Grand Canyon collision should be the kindling spark that has aroused both the flying public and the general public to the dilemma of air traffic control. Irony because well-published data reveal that air traffic control had no part in the incident. For three years informed industry and agency people have been clamoring against "the day when—" asking for more funds to get more and better equipment, techniques and personnel.

An aroused public and Congress may now insure more and better equipment, it may sponsor faster development of new and better techniques. It may also enable agencies to hire more "warm bodies" as ATC people like to call new, untrained personnel thrown by operational necessity into active positions for "on-the-job" training. Usually this means a harassed over-worked experienced man taking time and attention from his own position to aid and shelter the trainee controller until he is safe to "solo" an active position of operation, in the madhouse called "Tower" or "Center."

How often have pilots, enroute along the controlled airways in rough weather, or descending pell-mell into a crowded hi-density area on full instruments, wondered in what manner of man they have put their trust and lives? Where did he come from? Or like Topsy, does he just grow into an ATC controller? Some had a hazy idea that years ago when pilot jobs were scarce, fliers and air crew men of all categories, airline operations personnel and what-not, applied to and were em-

ployed by CAA to staff the nation's airways. Now that airlines are vying for the most embryo of pilot material with salary futures far beyond any civil service prospect, where does this character out of science-fiction, a multi-armed, many-faceted-brain creature that talks out of several mouths simultaneously at machine-gun speed, come from? One answer, in the future at least, is hoped to be the CAA's training center at "Oke City."

Not since the early 1940's with impending war and increased traffic, has the CAA trained entrance grade ATC personnel in centralized schools for its field facilities. It has been the policy of the CAA since that time, because of budget limitations, to hire personnel with good aeronautical backgrounds, and assign them to facilities for on-the-job training as vacancies occurred. This program is no longer adequate to provide for turnover of personnel and to prepare for expansion because the recent developments in all segments of aviation require an immediate solution to mounting problems in Air Traffic Control. Our global concept of Air power, progression into turbo jet operation, and the almost 100% increase in traffic on the airways has forced earlier implementation of plans for future expanded air traffic control systems.

Here, an entirely new concept has to be recognized. Today, military or training mission ranges from 200 to 2000 miles, and may cover 10,000 miles before returning to home base. Activity of this type requires use of the common airways system, precise navigation, and little or no delay, because of

fuel limitations, at beginning or completion of a mission. Couple this with the tremendous increase in private, corporate and airline activity, and the problems, from a traffic control viewpoint, are compounded considerably.

The CAA had projected plans, within the scope of its budget, for the personnel and tools, such as Radar, to meet the constantly increasing demands by the users of the airspace. To supplement for a later delivery of equipment, and the funds to hire additional personnel, the CAA coordinated with the Military on an interim traffic control plan. The Air Force and Navy have provided Radar equipment on a loan basis to the CAA, installed in key areas such as Norfolk, New York, Tacoma, Tampa, etc. The equipment is operated by the CAA for the control of all air traffic, until such time as CAA can complete its own program. To fill the vacancies in the field facilities, and to provide personnel for the Radar Approach Control (RAPCON) program, was beyond the ability of an on-the-job training system, so the CAA turned to its training school.

The Civil Aeronautics Administration's Aeronautical Center is situated in the central part of our country, at Will Rogers Airport, Oklahoma City, Oklahoma. Included in the Center's rapidly expanding facilities for training are Aviation Safety, Pilot and Engineering Training, Flight Inspection, Engineering Maintenance and the Air Traffic Control courses. The Civil Aeronautics Administration personnel are trained here to meet the complex responsibilities inherent in the agency's obligation to provide an air navigation and air traffic control system suitable for all users of airspace, both civil and military. Other courses are conducted to assist CAA personnel to keep current with new developments, to maintain technical proficiency and to standardize methods and procedures.

The Air Traffic Control School at Oklahoma City has been in operation since 1947. Inaugurated to train personnel of foreign countries under the former Economic Aid program, the training was later expanded to include Air Force Officers for duty with AACS in foreign and domestic assignments. The CAA students assigned to the school brought the total present enrollment to 200 students.

The Air Traffic Trainee attends a basic 10-week course, which includes Air Traffic Rules, Aviation Weather, Communications, Navigation, Airport and Air Route Traffic Control, and associated subjects that complement the basic course. He is trained in the subjects necessary for the issuance of the basic Airman Certificate, and has to demonstrate ability in laboratory simulation of air traffic control problems.

The first three weeks of his time is spent attending classes and lectures on the basic subjects, and completing examinations toward the Airman Certificate. Considerable concentration and study are necessary during this period in preparation for succeeding assignments.

The fourth week the student enters daily lab work for half of the day, where practical application of the subjects is demonstrated.

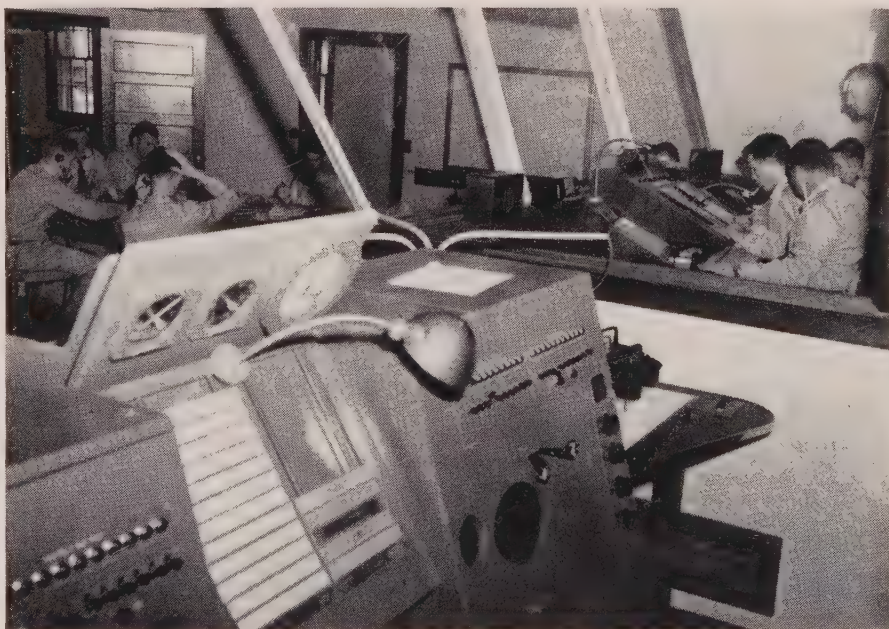
The school is equipped with six complete labs for traffic simulation. The Airport labs are complete standard tower cab layouts, with the airport and runways included on a large table outside the cab. The students simulate pilots of aircraft from the airport table, when not operating a control position in the cab. Each student is notated to operate all positions, but emphasis is placed on the local and approach control positions, because of the responsibility and complexity of operation performed at these positions. The lecture periods review events in the lab, and prepare for successively comprehensive lab problems as the students progress through the course. The Center labs are complete layouts, with associated remote rooms to simulate communications stations and towers, and with direct Center/pilot communications available. The tower and center labs are integrated as the problem progresses, to simulate a complete operation, so that the students can readily see how the movement of traffic is effected by their control.

The student is expected to show progress and aptitude in both tower and center operations, for assignment to either type facility. Upon completion of the course, the student is assigned to an operating facility, where it is expected that the basic training received will enable the trainee to quickly integrate himself, and become a journeyman controller in a minimum amount of time.

Some of the subjects taught are jet penetrations, radar introduction and procedures, criteria for standard instrument approaches for range, ILS, and VOR-DME; the common system, history of the CAA and traffic control, basic information on the users of the airspace, and other pertinent information to give the student as complete a picture of traffic control as is possible within the time allotted.

To handle such a momentous training program presented a challenge to the Air Traffic Control school and its staff of specialist instructors. Additional instructors with at least ten years experience in all phases of traffic control, were selected from towers, centers, and Radar Approach Controllers in New York, Washington, St. Louis, Chicago, Seattle, Indianapolis, Portland, Los Angeles, Boston, Philadelphia, Alaska and Hawaii. A wide range of air traffic control experience is represented by the twenty-five instructors now on the staff.

To determine the adequacy of the training received at the Aeronautical Center, additional groups of personnel were hired and assigned directly to operating facilities for on-the-job training. After a predetermined time, their progress will be evaluated in relation to the controllers who received training at the Air Traffic Control School. Formal air traffic control training is expected to continue so as to provide the agency with adequate numbers of new personnel during the next five years. The aviation public is watching the proceedings at Oklahoma City with interest.



WITH EXPERIENCED PERSONNEL who are familiar with all the potential variables of traffic control acting as pilots on the radio interphone, future air traffic controllers "sweat out" realistically simulated high density traffic problems. Any typical traffic snarls, such as sudden emergencies, or other irregularities that are likely to occur in the normal traffic flow, can thus be handled by the trainee without hazard or penalty. The system permits subsequent analysis by the instructor. The device in the foreground is a radar simulator, which reproduces typical radar problems.

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Round Table

(Continued from page 56)

speaking for, the business pilots who fly their own planes, and cannot have the advantage of executive maintenance; so I'm giving you my interpretation of it only."

Eichem: "In connection with what the gentleman said about the change of regulation, I want to emphasize that the change was brought about in accordance with the desire of the majority. It wasn't changed arbitrarily by the CAA. The draft release was circulated, changed, and recirculated. The desires of the majority were incorporated in the new regulations."

"With regard to the statement on hardship and work loads, I have already mentioned that to permit an airworthiness certificate to expire causes an additional work load for CAA, and creates a hardship for the owner. It's really not causing any hardship for CAA, because we will be inspecting airplane, or spot checking, or something else, except that we can't inspect the airplanes as fast as the certificates are expiring. Occasionally there is a one- or two-week delay before we can get to some particular airplane, which may be urgently needed. Occasionally we can readjust our inspection schedule, and make ourselves liable to the charge of favoritism; but actually the hardship is the airplane owner's, and the work load is on CAA."

De Groff: "I didn't mean to imply that CAA or CAB were at fault. The point I was making is that we individuals have such a hard time learning what we should and what we shouldn't do. We rely on someone to tell us, and he relies on someone else, and we're all confused. Actually, of course, that is the purpose of this meeting."

Kraemer: "I agree with you 100 percent that the change in regulations dealing with this choice of periodic or progressive maintenance is rather difficult. I find it that way myself and we deal with them. I sometimes wonder how industry does keep up with all the many regulations that apply to their operation, and especially when they are scattered throughout as many books and parts as they are. I know it is a very difficult problem, and I do wish that they could be a little better grouped. It has been studied and discussed, but apparently as of this time they haven't come up with anything that they feel would give more benefit than the present system."

Peterson: "Wouldn't it be worthwhile to give more publicity to the need for changing your certificate for a permanent one? In the Tulsa area, it was perfectly smooth for all of Sinclair's 26 airplanes; it was perfectly smooth for my airplane. All I did was to stop at the office and exchange the old certificate for a new one. Now, as for CAA being busy at something, they might as well be doing this inspection. But why should my airplane have to be inspected by a CAA representative be-

cause I was negligent, or because the local CAA man was negligent may have been negligent in getting the word out? The word had gone out to everyone in Tulsa, and anyone who hadn't changed their certificate just wasn't doing the job."

"We need these inspectors on other things—routine repairs and alterations and airworthiness directives. If it were publicized, as through this Round Table, everyone will exchange his certificate."

"Some regions are weeks behind now. They have work that they should be doing other than inspecting these airplanes. They are all right, and the authorized inspector is going to have to look at it before it flies anyway. Why does the CAA necessarily have to look at it?"

Eichem: "I think the reason they have to look at it is that, by an oversight in the writing of the regulation, they didn't provide that a mechanic holding an inspection authorization could perform original certification of an aircraft. Normally, in connection with original certification, operation limitations must be prescribed, and because of the great variance among these operation limitations, it was felt that this function should be retained by the CAA. But when they changed from the dated certificate to one of indefinite duration, that they had it in mind to place those airplanes in the "original" category. I feel particularly strong in that belief since Washington recently surveyed the possibility of making a change to relieve the situation."

"We in CAA also know there are other, what we consider higher priority functions that we should be performing, that would possibly be more beneficial to CAA and the industry as well. However, it is a work load that we are confronted with and it is something that is rather distasteful to industry when an airplane is tied down waiting an inspection by us. So we neglect our other work and try to conduct the inspection and get the airplane back in service as soon as possible."

Howard: "It might be appropriate at this time to mention that as I understand the evolution of this thing, the industry was clamoring for a change in the regulations, whereby they *could* use progressive maintenance. Isn't that what brought the CAA around to changing the regulation in the first place?"

Eichem: "Part of what brought it about, I think, was the great expansion of general aviation, and the impossibility of CAA giving detailed attention to every airplane and return it to service annually. They recognized this some time ago, and established the old Dami program, which was, I think, very successful. But the number of Dami's was limited to the number that CAA could supervise properly; also, it cost money to keep the Dami's trained and supplied with the materials they needed to do the job. So they have come up with a new program in which

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WRITE FOR LITERATURE



Aircraft Controls

BARBER-COLMAN COMPANY
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Round Table

(Continued from page 60)

the number of people is unlimited. There can be as many qualified inspectors as there are qualified people. People who have this rating will be required to procure the necessary specifications, manuals and data on their own, which should relieve the CAA of some expense. Those, I think, are some of the reasons why the regulation was changed.

"Another reason was that, in conducting all those annual inspections, the CAA was devoting a lot of time to a class of airplanes, which you spoke of, that is generally in good condition. Year after year, we kept putting papers in the file that we looked at your airplane and it was all right. We would like to get away from that.

"This program permits the people of industry to return those airplanes to service. It is relieving us of that duty, so that we can devote more of our time and effort to trouble areas, malfunctions or defects which might contribute to accidents. We also eliminate the other distasteful area of violation or noncompliance. These, I think, are some of the main reasons that contributed to the change of regulations." Barclay: "Rex Madeira, will you give us some of your ideas on progressive maintenance?"

Madeira: "To speak primarily as a fixed base operator, I must say that the

progressive maintenance system is not as compatible with any fixed base operator as it is with executive operators, such as Sinclair or Stanolind. Principally it's a matter of keeping records of the operation of the airplane away from the fixed base during the period that this progressive maintenance is occurring.

"We realized early that we didn't agree with this idea for a fixed base operation. People always resist change, and we knew that there would have to be a lot of education along with any program to establish progressive maintenance.

"We do a lot of maintenance on large fleets of U. S. Army airplanes, and there we see the great merit that progressive maintenance would have in fleet operations, because there we have standardized operations with very rigid schedules.

"We find that most of our customers have planned for periodic work. Engine changes are going to occur, and they have to be changed at certain periodic times. Each pilot or company has different ideas as to when those times should occur.

"Keeping records on our operations seems to be one of our major objections. Another is that, in progressive maintenance at a fixed base operation, it is necessary to tear down the same things to look at different portions of the airplane. You're going to have to uncowl a certain portion to do a certain job, and the next time it comes in you're going to uncowl the same thing and go through the repetition. The customer continually pays for fringe services that aren't a part of the item he's buying. In executive operations, you have the opportunity to do this job completely, and scheduling is your prime criterion in progressive. I think you have to have a pretty thorough schedule to make it pay off."

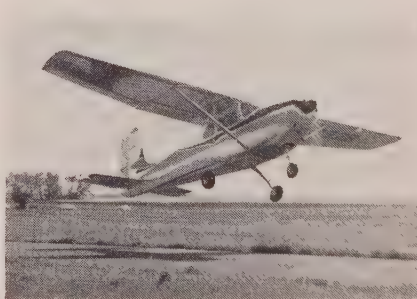
Barclay: "Does anyone else have a comment to offer? Bob, you had a point to make, I think."

Byrne: "Pacific Airmotive performs maintenance for other people and we have tenants who do a great deal of their own maintenance for other people under supervision and under our signing off procedure. I can only say from my observation of it it's a cross between the two. But it's a modified progressive maintenance because we don't do just a straight 100 hour inspection the way I know 100 hour inspection. They do some things one time the airplane is down, and other things the next time it's down. We use a modified progressive maintenance, I don't know what else to call it. Columbia Geneva Steel, for example, operates a couple of airplanes that are shuttling constantly, and the down time is a great sacrifice to them. They try to do as much as they can to the airplane every day it is down. There is always something they can do so they won't have to hold the airplane on the ground when they should be flying it. I think that's an example of progressive maintenance."

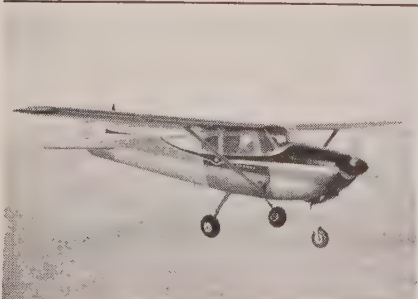
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Barclay: "That would be somewhat on the order of continuous maintenance."

Byrne: "Yes, continuous or preventive. We keep coming back to that idea."

Howard: "Progressive maintenance without good records, can be dangerous. I'm sure that every one of us has run into situations where someone had been pulling a preventive maintenance, and had overlooked, say, pulling up floorboards and inspecting cable, and that had slipped on one inspection and left out on another one, and the next thing you know when you finally did get in there for an annual you found something that was dangerous. Without good records as to what you have done, during this time, something of vital importance could have been neglected. Good record keeping in conjunction with anything of that nature is mandatory to a safe operation."

Kraemer: "It appears that preventive maintenance is the best system, and of course in progressive maintenance, record-keeping is very important."

"When the regulation changed it affected the owner-operator who did none of his own maintenance, such as the owner living in outlying areas, and who brings his airplane once a year to some mechanic for relicensing. That is probably the only basic maintenance he could have if he doesn't fly too much. And any mechanic may have been a designee, or he may have taken it to a mechanic who got it ready and got a designee to check it."

"Sometimes a problem would come up because of that situation. The mechanic may not have done the work to satisfy the designee, and caused a problem with the owner. 'The airplane's ready for inspection and now you want to do more work.' The new regulation helps in that respect; in that the owner-operator will most likely go to the mechanic who is going to license it, and when he's through it's all done."

"In my own case, where I do all of my own maintenance it's a little bit of a disadvantage to me in that previously I did all my own work, and it was a matter of a *spot check* by the designee for the annual. Rarely, have I ever done any work on an annual. That's been a preventative maintenance program. Now, I have to take the airplane to an authorized inspector and maybe I can help him or watch him, and pay him for doing what I could just as well be doing myself. That is the one disadvantage to the owner-operator who does his own maintenance."

"At one time I wondered if it would be practical for me to get into a preventive maintenance program for myself, because I've been through it all, except for propeller work. But I just relicensed my airplane last month, and after I got it licensed, it wasn't as much a problem as I had anticipated."

Eichem: "I think there's one point that we should not fail to notice: when we speak of progressive inspection, or periodic inspection, it doesn't mean that it includes the maintenance connected

with it. The airplane must be *inspected* either periodically or progressively, but it *doesn't* necessarily mean that it shall also be maintained by an A & E holding this rating. The inspection must be conducted by an A. I., but the work that he writes up to be performed to put the airplane back in proper condition may be performed by any A & E. I think you want to keep those two thoughts in mind. You still give the A & E the credit deserving of the certificates which he holds."

Kraemer: "As an illustration let's say I take my airplane up for a periodic, and it needs some work done, and I go ahead and do the work. Would the A. I. then have to check on that work afterwards?"

Eichem: "Not necessarily. If you're operating on periodic, as I understand the regulation, and the A. I. inspecting the airplane discovers some discrepancy which he wants corrected, he processes the necessary card to Washington saying that he has conducted a periodic on the airplane. In addition, he gives you a letter or a form stating the discrepancy which must be corrected. As an A & E you can correct the discrepancy and make a log book notation. If major repairs are involved, an A. I. or agent approval would be required."

Madeira: "I understand that that's an endorsement by the A & E on those discrepancies?"

Kraemer: "Then actually, that would (Continued on page 66)"

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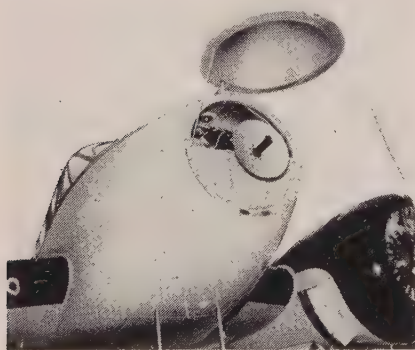
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"Flyweight" Airborne Radar Ideal For Business Aircraft

The smallest and lightest early warning weather-avoidance radar, a 50-pound system which will enable pilots to "see" and avoid storms and turbulent areas up to 50 miles ahead, has been developed by the Radio Corporation of America, according to Theodore A. Smith, Exec. V.P., RCA Defense Electronic Products.

"The new RCA radar system is the first weather-avoidance radar specifically designed for the 'flyweight' requirements of business and private aircraft," said Mr. Smith. "RCA plans to begin commercial production of the new radar system (AVQ-50) later this year. RCA has been producing for some time a weather-penetration radar system for larger and faster aircraft which enables pilots to 'see' storms and cloud forma-



tions up to 150 miles ahead and to locate smooth airpaths through turbulent areas.

"The invaluable services performed by RCA weather-penetration radar systems in large commercial airliners," Mr. Smith said, "emphasized the need for similar weather-information radar for small planes. The new weather-avoidance radar will provide pilots with a continuously changing picture of weather conditions, enabling them to 'see' in ample time to change course to avoid storms and turbulence."

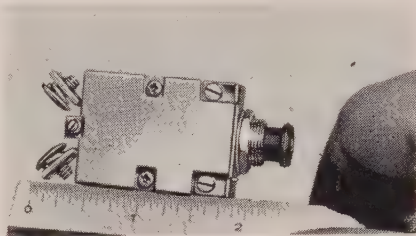
Similar in general operation to the larger AVQ-10 weather-penetration radar, the RCA weather-avoidance system utilizes a nose-mounted antenna to pick up storm formations ahead. The storm picture is projected on a radarscope mounted in the plane's cabin or cockpit.

The small-aircraft radar system also features circuitry which enables the pilot to switch-in a close-up view of a given weather area ahead, and provides a special antenna tilt-control to permit use of the radar for terrain mapping.

Miniature Aircraft Circuit Breaker

Mechanical Products, Inc., Jackson, Mich., has produced a new aviation circuit breaker weighing only 1.5 ounces.

In developing the new circuit breaker,



Mechanical Products was faced with the problem of reducing both size and weight without impairing the function of the breaker. This miniature breaker has performed very successfully under the severest tests. They are being made available to commercial as well as military aircraft.

The miniaturized breaker operates satisfactorily when subjected to conditions of extreme heat and cold; it can provide individual circuit protection to each circuit. It is no longer necessary to operate several circuits on one breaker because of space limitations.

Versatile New Industrial Camera

The Kodak Signet 40 Camera, a newly designed miniature, provides versatility for either a professional or beginner in industrial photography.

The camera is designed with an integral flash-holder, and can photograph either black-and-white or in color. It may be used for reproducing office procedures, training slides, employee photographs, assembly techniques, safety pictures, and many other industrial necessities.

An exposure guide for use with either color or black-and-white under existing daylight conditions is part of the camera, while a simple exposure guide for use with various combinations of flash lamps and films is part of the flash-holder.

Separate Ground Connectors

A complete electrical power loss occurred in a transport aircraft when the common ground connection to the aircraft structure loosened and caused the voltage regulators to operate in cutting out all four engine-driven generators. The incident was fortunately discovered during ground runup.

Accidental discontinuity of the connection leading from the voltage regulator to ground causes the generator

to go into overvoltage condition. The overvoltage relay of the fault detecting panel would cause the generator circuit breaker to trip out, resulting in a total power failure.

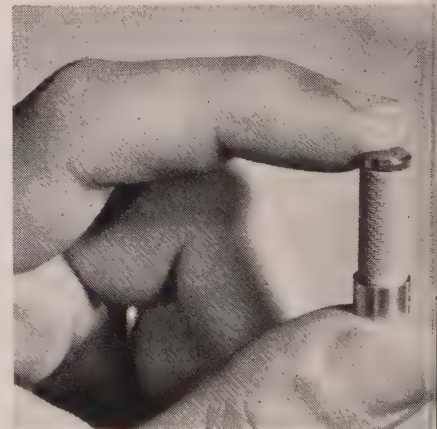
Since all four voltage regulator ground cables terminated on a single stud bolted to the structure, loosening of the stud affected the entire power generating system. As a cure, separate ground connections were provided for each regulator so that only one would be affected should such a condition occur again.

Credit—Flight Safety Foundation.

Filter-Protected Restrictors For Aircraft Hydraulic Systems

A two-way filter-protected restrictor of new design for use in aircraft hydraulic systems has been announced by Purolator Products, Inc., of Rahway, N. J.

The new restrictor contains a pair of tiny filter elements which remove all



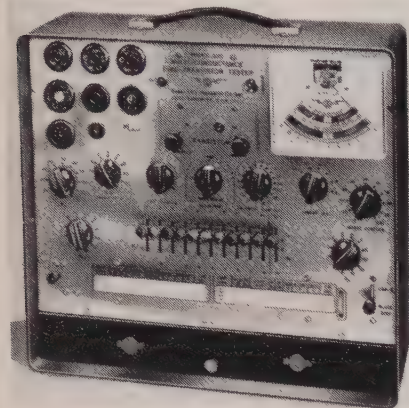
particles larger than .008 inches in size from hydraulic fluid before it passes through the restrictor orifice and again as it returns from the hydraulic cylinder on its way to the reservoir.

Designed for three thousand PSI operating pressures, the restrictor filter housing is constructed of one-inch aluminum hex material. Overall design length of the unit is 3 1/16 inches and connection are for 3/8" tubing in accordance with AND 10050-6 specifications.

The stainless steel filter elements are 5/8" long and have a diameter of 7/16". The elements are made of helically wound stainless steel ribbon type wire of special construction. For cleaning purposes, the elements are easily accessible by removing the head from the restrictor housing. A one-way filter protected restrictor is also available where a rapid return flow is desired.

Combination Tube— Transistor Tester

RADIO CITY PRODUCTS CO., of Easton, Pa. is offering their RCP 325 combination tester which accurately tests N-P-N and P-N-P Type transistors as well as all radio tubes, including magnetically-deflected b&w tubes and all series-string heater types.



Among the all inclusive tests is the dynamic mutual conductance test which measures the effect of the control grid on plate current flow. Signal and bias voltages are applied to the tube grid. Proper separate high voltages are applied thru separate loads to plate and screen.

Potentially weak, gassy or low-gain tubes are quickly spotted where ordinary tube testers would indicate "okay." As an added safety feature, the meter reads "line voltage" until one of the two "test" switches is pressed.

The RCP 325 tests all commercially used transistors under actual operating conditions. Current amplification is accurately measured using a constant-current bridge and low-impedance power supply. A unique diode-limiting circuit protects the sensitive 50 ua meter against burnouts due to shorted transistors.

The fully-portable instrument case measures 15 1/8" x 14 1/4" x 5 1/2" and includes a probe compartment and built-in pin straighteners for 7 and 9 pin tubes. Distribution is through the company's Ardmore, Pa. division.

New Reflective Coating For Airport Markings

A new coating kit called "101", with materials for reflectorizing such safety hazards as curbs, traffic islands, etc., is announced by Cataphote Corp., Toledo. It is reported that this new coating is visible four times farther than previous markings.

The new "101" coating is especially effective for reflectorizing airport runway markings, providing taxi routings and other visual data normally available only in daylight, without the need for hazardous obstructing signs.

The kit consists of five gallons of specially formulated binder that can be sprayed or brushed on, 75 pounds of minute glass spheres smaller than sugar grains, and a hand-operated sphere applicator. It provides enough material

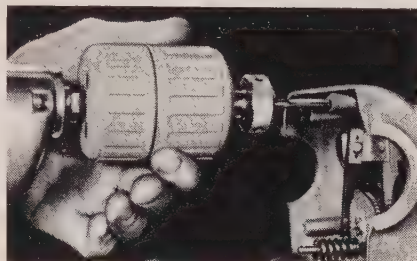
for 750 square feet of reflective coating.

Reflection is immediate upon application of the high index glass spheres while the binder is still wet. Available in white or yellow, the binder sets to the touch in ten minutes, and dries hard in forty minutes.

Instant-Reversing Power Tapping Tool

The Supreme Push-pull Tapper is an instant-reversing speed reduction unit made expressly for tapping. It attaches to any portable drill. The speed reduction of 7:1 in the driving direction gives the operator more than adequate power to tap all materials. The direction of the tap can be reversed without stopping the drill motor. Thus the operator can move the tap into and out of the hole at will.

Especially useful in light metal jobs such as aircraft trim work, it enables use of machine screws in lieu of self-tapping screws—a distinct advantage where future servicing and access to structure is important. Another big advantage is the extra "feel" it gives the user. The forward housing is held in the fingertips, and any unusual strain is felt instantly. The tap stops when the fingers are released, and runs



in reverse when the rear housing is held.

It handles all taps up to 5/16" and is made by Supreme Products Corp., 2222 S. Calumet Ave., Chicago 16, Ill.

Versatile New Line of Hydraulic Rescue Equipment

Hydraulic rescue equipment featuring remote operation, speedy adaptability to a great number of situations, compactness, and freedom from outside power sources has been made available by the Blackhawk Mfg. Co., Milwaukee.

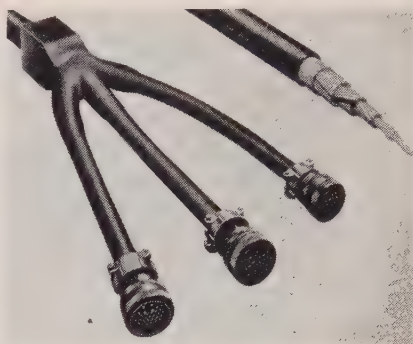
Designed in sizes to provide force up to twenty tons, the Porto-Power line comes in kits which adapt the hydraulic ram so that it will lift, push, pull, spread or clamp. Rams are available in four, ten and twenty-ton capacities.

Power is applied through the ram with a hamp-operated pump, providing steady, controllable pressure, and eliminating any of the danger inevitable when using saws or acetylene flames. The safety margin is increased by the quick, easy adaptability with which the Porto-Power ram can be suited to the job at hand.

The equipment should prove valuable to airport operators as well as to factories and repair shops.

Multi-Branch Multi-Conductor "Breakout" Cable

Developed specifically for missile wiring, but adaptable for commercial aircraft, is a new "breakout" cable by Pacific Automatic Products.



In this "breakout" are 141 conductors, layed by a special planetary strand. Although terminating in a 3-branch breakout, this cable permits continuous circuitry as there is no junction. Furthermore, circuits can be completed between any two or all three branches without originating in the prime cable.

Sheathed in neoprene and water-tight, the cable is fungus and rodent-proof, and is not affected by short term exposure to oils, acids, alcohol, ozone, water or long term exposure to sunlight. The cable has a flexibility from -65°F to +175°F. Connectors are sealed against moisture and dirt.

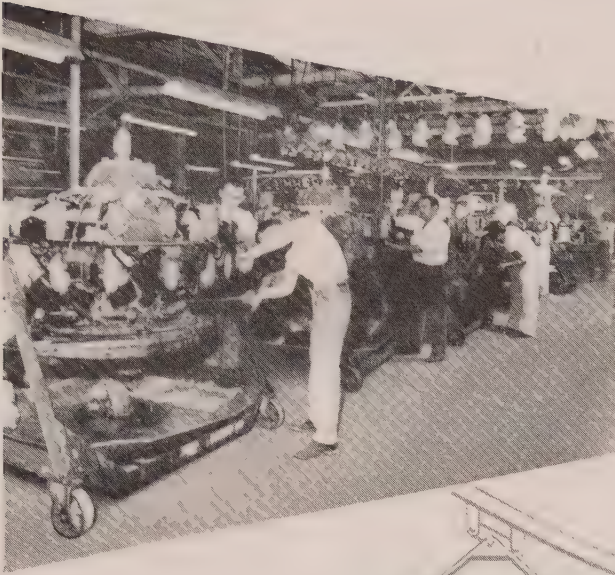
Socket Wrench Cuts Torque Maximums

The new JOTRU torque limiting socket wrench permits maximum torque variation of only \pm two per cent under actual operating conditions. Designed for production line or construction use, the durable Jo-Line (of South Gate, Cal.) tool is completely automatic, eliminating any need to listen for clicks or to watch for flashing lights. The JOTRU is available in sizes from 10" to 36", with range settings varying from five to 500 foot-pounds.

A special feature of the tool is a hammering surface opposite the tang that enables it to knock out mismatched pieces of an assembly without damage.



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Round Table

(Continued from page 63)

be more liberal than the old system." **Eichem:** "In the old system you were almost required to take the airplane back to the designee to have them verify that you had performed the work."

Barclay: "Let's recapitulate some of the information brought out at this meeting. I think there are desirable features of the progressive type inspection, but that probably very few people can or will take advantage of them. I gather from the opinions expressed that the average operator of small planes, or the private owner, is probably better off staying with the periodic inspection. One reason we have discussed is that it takes an elaborate bookkeeping system and controlled scheduling of the aircraft in order to determine what has or has not been done in a progressive system. Another reason which has been mentioned here is that, for the small operator, progressive maintenance would mean a lot of repeat operations. For example, the cowling would have to come off one week to check ignition, and the next week to check the fuel or hydraulic system, and so on; with the periodic type inspection, all systems would normally be checked at the same time."

Howard: "It would be hard to come by the manual that he would operate by that would give him these time extensions and things. Even if he had a fleet that was large enough to take advantage of progressive maintenance, he still has to have the background to make up a manual that would allow these various extensions in time, and call out the times that the various maintenance would be performed on the airplane. That in itself is quite a complicated thing."

De Groff: "I would like to ask one question, regarding A. I. inspection and taking it back to the A & E for write-off. Is it possible for the A. I. to walk down a tied-down row of airplanes—this is scuttlebutt, as it were—but say, 'Well, here it is, and here it is, and that one we'll ground all week.' Again, I'm coming right back to the education program, which has been mostly tossed-around hangar flying."

Eichem: "You threw me there when you said, 'Ground the airplane.' I thought you were talking about the inspection. The A. I. does not have the right to accept, he must make his determination by physically looking."

De Groff: "Well, he physically looks at that row of tied-down airplanes, and picks out this one and that one and he has nothing to do with them at all. Now, he can assert his authority to go out and spot check aircraft for the purpose of removing them from service?"

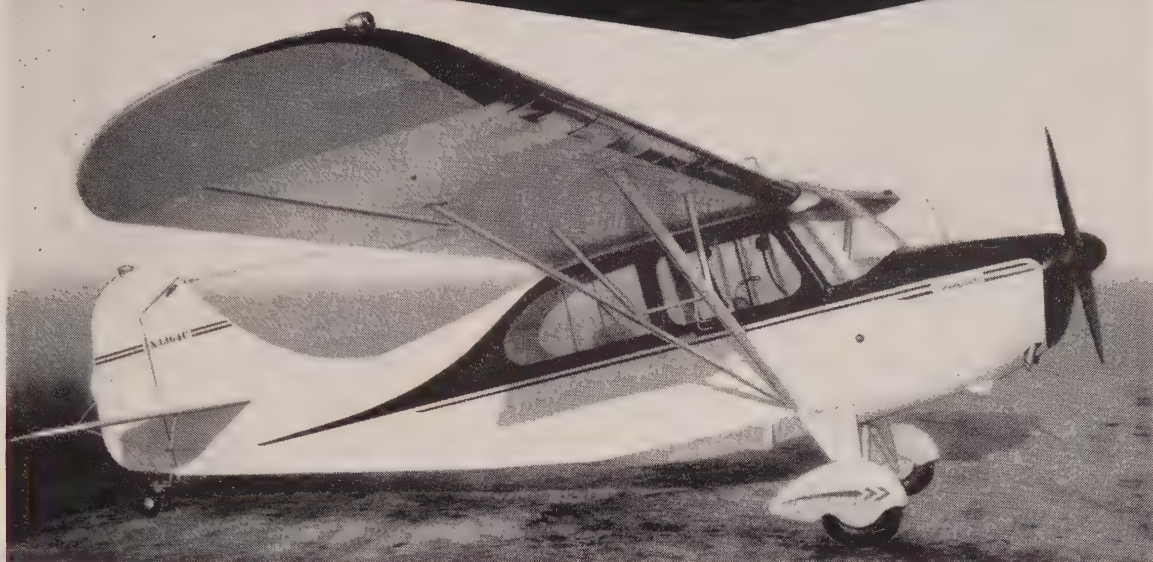
Eichem: "Well, if that is the sum of the scuttlebutt or hangar talk that has gone around, then it's the educational program that is needed."

De Groff: "That is not part of the pro-

(Continued on page 68)

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Round Table

(Continued from page 66)

gram, as I understand it."

Eichem: "No, but that's the way some of them interpret it; however, he has authority to approve or not approve the airplanes that are brought to him."

Byrne: "I'd like to ask one question. We've been talking almost entirely in the direction of the people who are most anxious to do the best possible maintenance on their airplanes. How has this new picture affected the unfortunate few that we always have to cope with who try to see how little they can do to keep their airplanes up? There are some of those everywhere

around the country, and I've run into them in the past and I've always thought that the designee system fostered, to a certain extent, poor maintenance in a lot of areas where the designee was an employee of an operator, was not going to stick his neck out to ground the airplane because it wasn't properly maintained. I've seen airplanes come into Pacific Airmotive that shouldn't have been flying for the past 6 months or a year, and we've seen airplanes come in that have been signed up every 100 hours by somebody, and our own boys would guarantee that the plugs hadn't been out for 300 hours. Now, how is this new program affecting the people who do

not take care of their airplanes?"

Eichem: "My opinion on that is that by permitting these mechanics with this inspection authorization to handle the return to service of aircraft, it will permit the CAA agents to devote more time on these particular problems and with these particular people that you speak of."

Byrne: "In other words, you have more time to trouble-shoot the weak spots."

Eichem: "Through surveillance and hearsay, they will be attracted to these people, and can spend more time working with them or through other measures seeing that they do meet the same safety requirements as the majority does voluntarily."

Barclay: "Gentlemen, it appears that our time is up. I want to thank you on behalf of SKYWAYS magazine for your participation in this Round Table discussion of Progressive versus Periodic Maintenance."

How Freight Got Wings

(Continued from page 39)

only a hairline divided Slick as a going concern and Slick as a bankrupt and even less of an edge separated the officers and personnel from discouragement and tossing in the sponge. But faith in themselves, in the future of air service for the needs of American business and the perseverance their military service had taught them, kept them going.

The purchasing department griped about the large amounts of red ink needed in the early years and it was a long time before the line was safely in the black. But the amount of cargo continued to grow apace. As early as August, 1946, the new line was chalking up records. It became the first airline to fly a 1-million revenue ton mile month. In October, 1946, it broke the record with 2 million; in May, 1948, with 3 million; in October, 1950, with 5 million. It chalked up a lot of other firsts as well. During its first year of operation, it received the Aviation and Air Transport Maintenance Award. It originated air freight service on an area-to-area basis, rather than from point-to-point, and applied for a certificate of public convenience and necessity on that basis. It was the first air freight line to file a common tariff for freight.

It had the vicissitudes of any pioneer. Price wars, a long struggle to become a scheduled airline, too much air freight moving in one direction with half empty planes going back, were some of the problems. A move that almost ended fatally for Slick was its proposed merger with Flying Tiger Line, Inc. After this fell through in October, 1954, because of labor protective provisions, the airline was indeed in a bad way. In effect, it had to start from scratch, which it proceeded to do in many ways. One was to bring in Delos W. Rentzel, former chairman of the Civil Aeronautics Board, to head the company. Mr. Rentzel, who had extensive experience in transportation generally, started out by trying to straighten out the airline's

(Continued on page 70)



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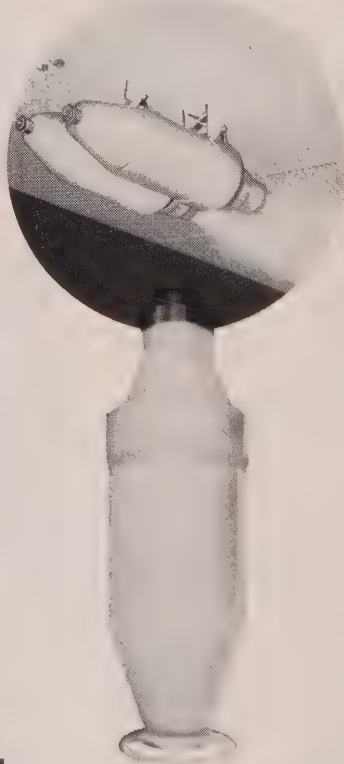


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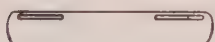
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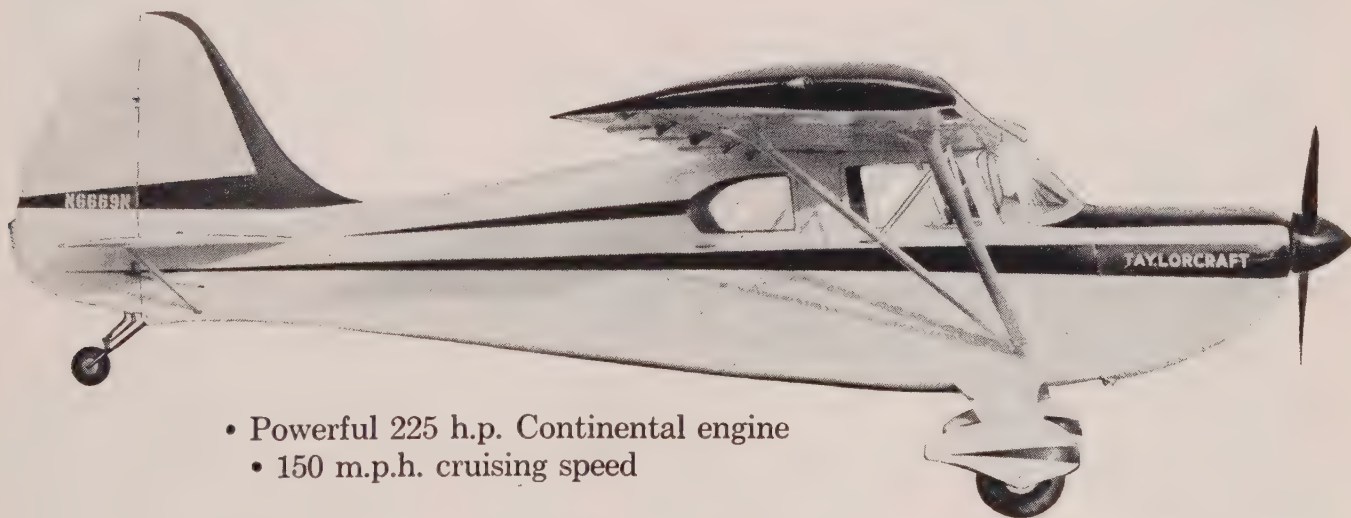
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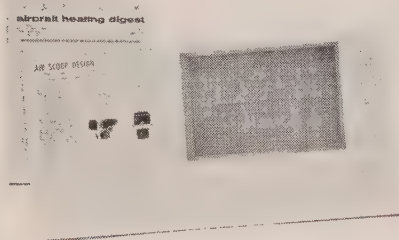




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Air Freight

(Continued from page 68)

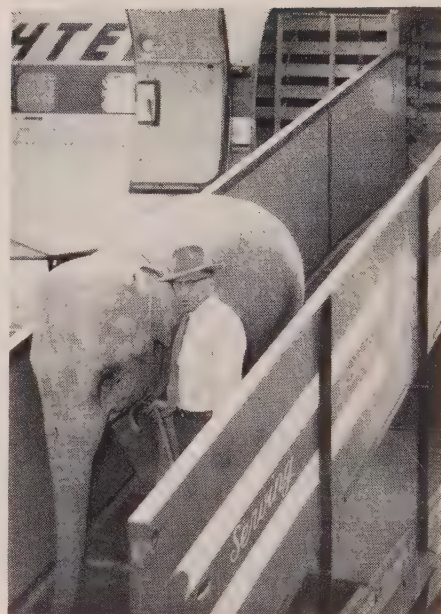
equipment problem. At the time the merger fell through, Slick had a fleet of 12 airplanes, consisting of 2 DC-6A all-cargo planes and 10 C-46 aircraft. It has constantly been rebuilding and now can claim the world's largest fleet of all-cargo aircraft. The administrative position of the airline was further strengthened in May, 1956, when Robert J. Smith, another man with wide experience in air transportation, civil and military, became president and a member of the Slick board of directors.

Slick's growth was not limited to equipment, but encompassed as well many services to business in addition to its domestic air freight. And the growth of profits was a bright spot at the end of a decade of operation. Slick, over the years, constructed and improved a plant at San Antonio for the servicing and rebuilding of engines and established such a reputation for this work that it soon was asked by the U.S. Air Forces to provide them with similar services. In time this was even extended to some of the airline's competitors. It led as well to contracts with the armed services for the transportation of freight, household goods and personnel to far corners of the globe. This in turn suggested other services which Slick could provide for business in its policy of supplementing the air power which the business firms themselves had through their executive fleets.

For example, Slick recently put into operation its Sky-Van Service which enables personnel managers to expedite the movement of transferred personnel by moving their household goods and personal effects swiftly by air to enable them to become settled quickly in new locations. Not only does this please the transferee and his family through reducing the necessary period of "camping out" and temporary accommodations inevitable during transfers, but it saves the company quite a bit of the money that would otherwise be necessary for per diem expenses. Special services for air movement of pets are also provided.

A charter service has also been developed that appeals to industrial relations managers and others charged with recreation programs for groups in industry, as well as for other bona fide groups such as fraternal lodges. This permits the group to fly together to overseas destinations in luxurious planes at rates that are considerably less than would prevail for individual bookings on commercial international airliners. A further advantage is that, when the group is of salesmen or executives, the time normally spent in transportation can be productive time, as well, and used for en route conferences, etc.

While Slick has continued to expand its services, it has never deviated from its belief that the American economy would greatly benefit by use of air movement. The businessmen of the country have responded with enthusiastic acceptance of every Slick innova-



LIVE cargo has been important to Slick since its beginning. The air line has carried race horses, and practically every other kind of animal from parakeets to pachyderms. This elephant is debarked on ramp used for horses.

tion and expansion of service. In the cold figures of financial statements, black figures this time, Slick's operations for the first six months of 1956 bear this out. In that time, Slick carried a total of 37,569,000 ton miles of freight and passengers, an increase of 75% over the same period in 1955. The little band of pilots who helped Earl Slick set up the airline by making themselves generally useful, has expanded into an organization of some 1,800 people. The moral seems to be that dreams—even GI dreams—do sometimes come true. Or maybe the moral is: "You can't keep a good airline and the spirits of a bunch of air-minded young men down!"

Bell 47G-2 Climbs Mt. Rainier For Geological Survey Team

As part of a 3000-square-mile survey by the United States Geological Survey for the State of Washington, a Bell 47G-2 helicopter made seven round-trip flights to the 14,410-foot summit of Mount Rainier carrying camp equipment, rations, instruments and personnel.

The purpose of the flights to the summit was an exact measurement of the height of Mount Rainier, which required precise triangulation from the summit of Rainier and from four other points whose precise altitude was known.

The Bell 47G-2 was stripped down to about 1870 pounds including pilot and 15 gallons of fuel. The helicopter carried as much as 200 pounds of equipment on a single flight to the summit, landing on ice in temperatures which varied between 10 and 25 degrees and in winds varying from 5 to 15 mph.

New Plane for Agricultural Flying

A new "composite" aircraft designed to meet the unique demands of "ground level" agricultural flying, one of the fastest growing segments of industrial aviation, was recently designed and put into production by National Aircraft Corp., Burbank. The specifications of the plane, the NA-75, represent the joint research of NAC engineers and pilots and operators of the agricultural aviation industry.



Features of the plane are the National "Hi-Lift" biplane wings, which permit payloads of 2000 pounds and stall speeds as low as 35 mph, and modern design dispersal equipment that minimizes drag and permits instant convertibility to dust or spray operation. The NA-75 also has special metal fuselage panels which can be removed from firewall to tail, using only a screwdriver, in five minutes.

The plane is available in complete form, or each or all of the main features may be obtained in kit form for use in modifying Stearman planes now in use in the industry.

Alternative power plants for the NA-75 are: Continental 220, Lycoming 225 or 300, Jacobs 245 to 300, Pratt & Whitney 450, or Wright 425. With a 220 hp engine, the NA-75 can take off in 890 feet with a payload of 1250 pounds. A 450 hp engine will get it off in 785 feet with a 2000 pound payload.

The National "Hi-Lift" wings are Gottingen 398 configuration, and have flown over 90,000 hours without a failure. Made of fabric-covered metal, they may be assembled or repaired with a wrench and a screwdriver.

A single 31.7 cubic foot fibre-glass hopper holds either dust or spray. A full load can be dumped, in emergency, within five seconds. Parasite drag is minimized by mounting the spray pump and plumbing within the fuselage, the spray boom in the trailing edge of the lower wing, and using an airfoil-type dusting venturi.

For safety and visibility, all instruments are in the trailing edge of the center wing section, and the plane is designed to fly in a nose-low attitude.

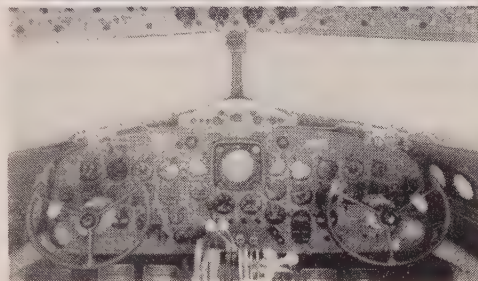
Tests For New Lube

Trying to beat the persistent problems of lubrication in aviation gas turbines, engineers of the Westinghouse Electric Corp. have turned to a new silicone lube fluid. The new jet "oil" already shows signs of outstanding performance.

Reports so far indicate that the silicone fluid has passed viscometric and thermal stability tests. The range of these tests has been from -65° to +500° F.

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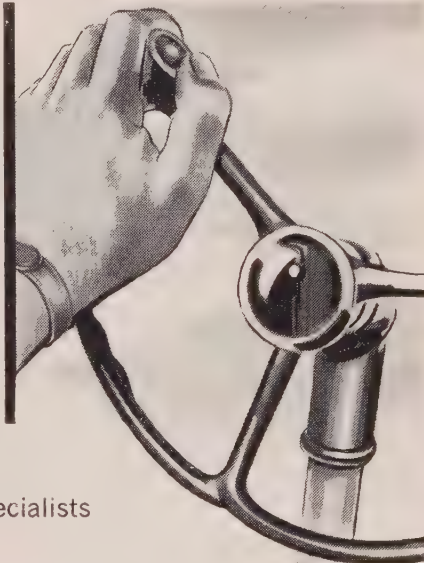
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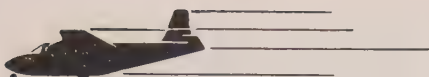
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BELLANCA IS BACK with a new high performance business plane ideally suited to the needs of salesmen or as a supplement to executive fleets. The Bellanca Cruisemaster is again in production, now under the direction of a new company, Northern Aircraft, Inc. Roy L. Strong, President, says, "We have introduced some modifications which now make the Cruisemaster the fastest four-place, single-engine business airplane in the world." The new Cruisemaster is reported to have a 230 hp Continental engine and a cruising speed of over 200 mph. Plastic-laminated plywood wings give high strength/weight ratio. Hartzell constant speed propeller is standard, McCauly optional. High capacity standardized hydraulic system raises gear in two seconds, permits easy maintenance. Standard fuel capacity of 55.5 gallons gives 1000-mile range. Service ceiling is 20,000 feet. Retail price of the Cruisemaster is set at \$15,792. The Cruisemaster was designed by G. M. Bellanca, designer of the first cabin monoplane, the first monoplane to cross the Pacific, and the first monoplane to cross the Atlantic non-stop from the United States to Germany. An early production model of the Bellanca Cruisemaster will be test flown by SKYWAYS.

Bell 47J Starts 17,000-Mile Tour

A Bell 47J helicopter piloted by Joseph Mashman, recently left the Bell Fort Worth plant on an unprecedented 17,000 mile demonstration tour of Central and South America.



Named *The Silver Hummingbird*, the 47J will fly the whole distance and visit 15 countries to demonstrate the new utility helicopter to the perennially strong Latin American commercial helicopter market. The trip will also be a practical demonstration of 47J reliability.

The silver-and-black 47J will have an auxiliary fuel tank to give it a 600-mile range. It left the plant at maximum gross weight of 2565 pounds. Bell Service Representative Joseph Beebe accompanied Mr. Mashman. The 47J carried all the personal belongings of the two men. The only spare parts carried were extra spark plugs, cooling fan belt and distributor points.

New Division for Tactair Autopilot

The Aircraft Products Co., Bridgeport, Pa., manufacturer of Tactair autopilot for business aircraft, has established two new divisions, the Tactair Autopilot Div. and the Tactair Valve Div. as part of its current expansion program.

The Tactair Autopilot Div. will produce the industry's first completely pneumatic 3-axis model. Suitable for such planes as Cessna, Beech and Piper, the lightweight autopilot operates without electricity. The Autopilot Div. will also conduct research and development activities in yaw dampers, tactile feeler signaling devices, and related tactile aircraft controls.

Continuing production of the company's line of aircraft valves and specialized hydraulic and pneumatic components, the Tactair Valve Div. will also produce a new pitot-static tester, described as a portable laboratory of indicating instruments making possible the flight-line testing of pitot and static systems in aircraft.

New Fuel System for Cessna 310

A new fuel system has been announced by the Cessna Aircraft Co. (Associate Member, NBAA), Wichita, Kansas, which will add about an hour and a half to the range of the Cessna 310. The 30-gallon system, which will cost \$1485, will be available for installation about October 31st.

The new system will incorporate two 15-gallon rubber fuel cells, which will be connected to the regular 50-gallon fuel system of the 310, and which will add only 16 pounds to the empty weight of the plane.

... in the business hangar

■ Spartan Aviation Service, Tulsa, has completed an executive conversion of a second Lockheed Ventura for Northern Gas; Les Richardson and Bill Mackey took delivery. Equipped with Collins electronics, the Ventura features the first commercial installation of the AP-101 autopilot. □ Sam Palmer flew the Mid Continent Beechcraft B-18 to Spartan for 100-hour inspection and miscellaneous repairs. □ Harry Severs brought the Standard Oil of Ohio Lodestar to Spartan for engine and propeller work. □ Stan Gerding of Mead Corp. is having Spartan reseal center section fuel tanks, install dual fuel system, and other miscellaneous work on their Lockheed Lodestar.

■ Pacific Airmotive, Burbank, has been awarded an Air Force contract for the overhaul of 497 helicopter engines. PAC has already overhauled more than 2400 engines for the Air Force.

■ Dallas Aero Service, Love Field, has been named distributor for the DC-3 Maximizer Kit produced by AiResearch Aviation Service Co. By improvements in engine cowling, exhaust baffles, oil cooler fairing, wheel-well doors and tail wheel, the Maximizer guarantees an increase of 20 mph without increased horsepower. Installation of Maximizer by Dallas will take 200 man hours. □ Dallas has also been named licensed dealer for the Beechcraft D18S Safety Performance or Speed Kit produced by Airline Training, Inc. Kit increases Beechcraft speed by 20 mph and range by 10%.

■ Southwest Airmotive Co., Dallas, has completed a double engine change and 1000 hour inspection on Lion Oil Co.'s Lodestar. Meanwhile, Lion pilots Gerald Gammill, Jimmy Ladd and Dwain Smith and mechanic Earl Forth flew the company's Beechcraft. □ Pilot Jack Norton and mechanic Bud Parsons brought the Lockheed Aircraft Lodestar to SAC for 100-hour inspection. □ Pilot Hugh Hass brought O. R. Burden Construction Co.'s newly-acquired Twin Beech to SAC for 100-hour inspection and periodic check. □ Delhi-Taylor pilot Johnny Erwin recently brought the company's Lodestar to SAC for 100-hour check. □ Trice Productions Pilot John Senix brought his Twin Beech to SAC for double engine change.

■ Lear Aircraft Engineering Div., Santa Monica, has begun work on the conversion of Warren Petroleum Co.'s Lodestar to a Learstar Mark II. Delivery is scheduled for early December. □ Lear Aircraft Engineering Div. has installed the L-5 autopilot system, Bendix X-band radar, Janitrol heater, complete exterior painting, and several other modifications on Johnson & Johnson's DC-3, Bob Darnall, Pilot. □ Learstar type rudder spring tabs have been installed on the second Columbia-Geneve Steel Co. Lodestar at Lear AED. Roy Rollo is Chief Pilot. □ Installations of Bendix X-band radar, Learstar spring-tab system, and a complete exterior paint job were completed on the second U. S. Steel Lodestar brought to Lear AED. Don Teel, U.S.S. Chief Pilot, took delivery. □ A third Learstar Mark I has been ordered by U. S. Steel, NBAA member. The radar equipped plane will be identical to the two previously delivered to U.S.S., except that the fuel capacity will be increased from 1125 to 1350 gallons for longer range.

■ Dallas Airmotive, Dallas, was host to Don Richardson, Chief Pilot for NBAA member Minnesota Mining and Manufacturing Co., whose visit concerned overhaul of the R-1830-94 engines on MMM's DC-3. □ Engine overhaul has been completed on Eastman Kodak's DC-3, Ralph Bailey, Pilot. □ Another DC-3, this one from Texas-Illinois Pipe Line Co., Harvey Glass, Chief Pilot, visited Dallas Airmotive for engine overhaul. □ Al Krumpelbeck, Pilot, and Ray Jennings, Co-pilot, brought Swiftlite Aircraft Corp.'s twin Beech to Dallas for overhaul of the R 985 engines.

■ Remmert-Werner, St. Louis, has completed conversion of another executive DC-3 for NBAA member Dow Chemical Co. The all-weather conversion accommodates 14 passengers, has adjustable desks, electrical facilities for dictating and calculating machines, soundproofing, galley, lavatory, large picture windows. Electronic equipment includes Bendix X-band airborne radar, with ground mapping and Racon beacon facilities, Sperry A12 autopilot, Collins 51R3 omni with RMI and integrated flight system, Collins 17L-51X VHF 360-channel communications system, Collins 51Z marker and dual Collins 51V2 glide slope receivers, and custom radio and instrument panels. R-W also supplied Dow with their first executive DC-3. □ R-W has also completed an executive DC-3 for Mead Johnson Co. Passenger facilities similar to Dow's DC-3; electronic equipment includes Collins 17L4-51X VHF communications, dual 51R3 omni, dual RMI, dual ILS, marker receiver, Bendix OmniMag, dual Bendix ADF radio compasses with flush loops, special radio and instrument panels. Peter Beard will be Mead Johnson's Chief Pilot.

(Continued on page 79)

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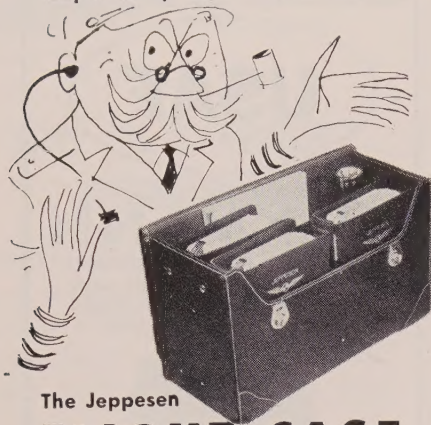
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General News

Recently Issued Patents Of Aviation Interest

From a survey of recently issued U.S. patents, several have appeared to be of interest in the field of aviation fuels.

A jet fuel additive is the subject of Patent No. 2,712,496 which has been issued to Sol Skolnik and Howard W. Kruse and assigned to the Secretary of the Navy.

This patent relates to the use of aniline as a jet fuel. Two of this substance's chief disadvantages as a fuel are that it freezes at about six degrees below zero Centigrade (6.2 to be exact) and that it has an awkwardly long ignition delay. The Skolnik-Kruse-Navy patent claims that both of these factors are overcome by adding 15% of hydrazine to the aniline fuel.

Another beefing up of fuel quality is the purpose of Patent No. 2,708,082 issued to Homer M. Fox and assigned to the Phillips Petroleum Co. This patent claims that better engine starting and combustion efficiency may be obtained throughout a broad range of temperatures by adding a viscosity-index improver to jet fuels. Examples of such improvers would be Paratone, Acryloid 710, and Santodex.

Better usage of nitro-paraffin gel in jet propulsion devices is the subject of Patent No. 2,712,989 as issued to Herman Maisner. Indication of the sort of devices in which this patent may prove most useful is given by the fact that the patent was assigned to Aerojet-General Corp. The patent claims to provide a system whereby nitro-paraffin gels retain their consistency for long times.

The patent relates specifically to the method of preparation of the gels.

Westinghouse Shows Anti-Skid Safety Device

Called DECELOSTAT, the equipment developed by the Industrial Products Division of Westinghouse has the dual advantage of making landings and takeoffs safer and of reducing tire wear.

The anti-skid unit is mounted in the hub of each wheel and is integrated into that wheel's regular hydraulic braking system. These controllers automatically regulate the braking of the wheel to surface conditions of the runway under the wheel, reducing the braking effort whenever there is a tendency for the wheel to lock and slide.

Accurate data compiled in an airline test over two years showed that DECELOSTAT increased tire life, reduced wheel balance vibration and produced overall better braking.

First Steps in Cessna Expansion

Construction is under way at Cessna Aircraft Co.'s new Wallace Plant at Wichita, Kans.

The first phase will include a power plant building, operations building, and 50,000 feet of a production flight hangar. A 50-foot taxi-way to Wichita Municipal Airport, parking area, ramp area, and additional supporting areas

are also included in the initial phase, which is expected to be completed by August, 1957. The second phase, to begin shortly, will include a two-story engineering building of 44,000 square feet and a 20,000 square foot experimental hangar.

Announcement of preliminary construction followed by only a few days Cessna's revelation of the \$10,000,000 expansion which would include a complete new factory and supporting facilities just north of Cessna's prospect plant in Wichita. Total area of the new facilities: 425,000 square feet.

Second Commander Ferried to Europe

Delivery has been made of another Aero Commander, this one a 560A purchased by Comptoir de L'Industrie Cotonniere, Paris, for the use of Marcel Boussac in traveling between his different business locations and farms.



The Aero Commander joined a fleet of company planes owned by CIC after its flight across the North Atlantic. Jean Moulignie, company pilot, ferried the plane. The transaction was made by Babb SARL, French distributor for Aero.

New Aircraft Battery Resists Overcharging

The latest Exide battery for aircraft now has Silvium alloy positive grids, a lead oxide active material designated GOX, and Pormax plate separators. Silvium, a patented alloy of silver, lead and other metals, has the highest resistance to electrolytic corrosion yet attained in lead-acid battery grid alloys. Thus, it is best able to withstand the abuse of overcharging common to long flights.

It also tends to keep pace with the trend toward heavier generating equipment required for bigger electrical loads. Sulfation of negative plates is minimized. GOX active material, having three times more surface area exposed to the electrolyte, improves performance at high rates of discharge. Pormax permits freer electrolyte penetration while providing superior plate insulation. Quick response to sudden power demands and unusually low self-discharge are features.

It is also understood that a special battery is now, or is shortly to be in production for business aircraft.

General News

... in the business hangar

(Continued from page 19)

■ Pacific Airmotive Corp.'s Chino, Cal., Div. has received a \$5.5 million A.F. contract for 293 C-47's. Work will extend through September 1957.

□ Don Beeler, Chief Pilot for Delhi-Taylor Oil, Dallas, brought the company DC-3 to PAC's Burbank aircraft division at Lockheed Air Terminal for installation of Convairst 340 type fuel system. Fuel tanks were removed from the center section area and integral tanks were installed in the outer wing panels. The new system incorporates a single cross-feed line. Former fuel-tank areas were modified for installation of 200,000 Btu heater, baggage and electronic compartments. □ Pac recently completed installation of DC-6-type wheels and brakes, Sperry engine analyzer and a new interior on Mesta Machine Co.'s A-26; other work included 100-hour inspection. Al Litzenberger, Mesta Pilot, is NBAA representative. □ Pittsburgh Coal's B-23 has returned from PAC with newly installed radar, A-12 autopilot, double engine change; relocation of pilot masts and 100-hour inspection also completed. □ Slick Airways' A-26 is at PAC Burbank shops undergoing modification of baggage compartment and compliance to nose-gear AD note. □ Dwight Reynolds, Chief Pilot for Camp Farms, flew the company's Twin Beech to PAC for 100-hour inspection, engine change and repaint-

ing. □ Malco Refineries' Lodestar 98W was in PAC shops for installation of Goodyear brake system, 100-hour inspection. Ship flown by John Lyon, Malco NBAA representative. □ PAC completed 100-hour inspections on the following: Union Oil Convairst 340, Jim Stevenson, Pilot; Columbia-Geneva's two Lodestars, Pilots Joe Basso and Roy Rollo; Morrison-Knudson's Twin Beech, Bell Evans, Pilot; Sear-Roebeck's DC-3, George Fleming, Pilot; Richfield Oil's two Twin Beeches and DC-3, Chuck Nickell, George Robertson and Joe Brown, pilots.

■ American Airmotive Corp., Miami, has become distributor for Collins Radio and AiResearch's Maximizer Kits for DC-3 conversion. □ A-A is enlarging facilities for executive aircraft service with addition of new \$2 million hangar.

■ General Aircraft Supply Corp., Detroit, has been appointed distributor for civil application of Aerojet-General's Jato units.

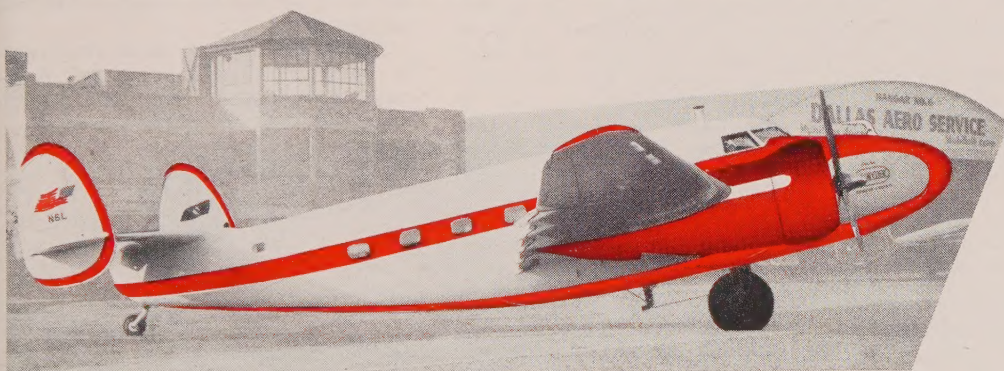
■ Van's Air Service, Winona, Minn., completed 100-hour inspection on Ray-o-vac Co.'s plane, the 19th for the plane, of which Van's has performed 16. □ Cessna 310 from J. R. Watkins Co. had its 2nd 100-hour inspection at Van's. □ H. D. Long Co. had their Navion in for repainting, new interior and installation of Hartzell propeller at Van's.

■ Horton & Horton, Fort Worth, completed customized Lodestar interior for McCullough Tool Co., including hi-fi radio, king-size executive table and rheostatically-controlled heating and lighting.

IRE Communications Symposium

The IRE Professional Group on Communications Systems has announced that the Second National Symposium on Aeronautical Communications will stress communications systems in support of present and future aeronautical activities.

The first session will be devoted to "Communication System Concepts," and will include the following addresses: "USAF Aeronautical Communications, A Link in the Servo Control Loop," by Lt. Gen. Joseph Smith, Hq MATS; "AF Communications Problems and the Future Air Force Operational System," by C. K. Chappuis, Rome Air Development Center; and "Aeronautical Communications Contribution to Public Safety Communications System," by W. C. Collins, Dept. of Communications of Los Angeles. The Fourth Session, "Communication Techniques," will include a speech by M. J. Cohen, of R. M. Wilmotte, Inc., on "Nuclear Radiation Applications to Aeronautical Navigational Aids for Airfield Guidance During Final Approach."



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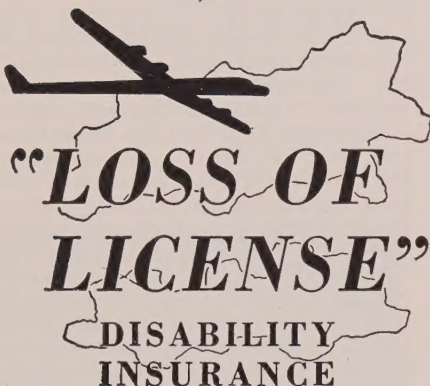
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General News

Bantam Tube and Magnetron for Ground and Airborne Radar

A new TR tube, nearly 50 per cent smaller than a comparable component, and a tunable magnetron, both for application in radar systems, were shown by Sylvania Electric Products Inc. at the Western Electronic Show and Convention in Los Angeles.

TR tubes are vital components of radar sets, serving as electronic switches permitting the equipment alternately to send and receive signals with one antenna.

The new miniaturized Bantam TR was developed to meet requirements in commercial radar for a tube combining small size, ease of installation and removal, and low cost. A broad-band tube operating in the 8500-9600 megacycle frequency range, the new device in some cases exceeds electrical characteristics of tubes nearly twice its size.

New Tunable Magnetron. Sylvania's new tunable magnetron has current application mainly in military radar. The device is a tunable 4J50 magnetron designed as a direct replacement for the fixed-frequency 4J50 now in use. A magnetron is an essential power-producing component in airborne, shipboard, and land-based radar.

The M561 can be tuned in a range of 600 megacycles in any portion of the 8500-9600 mc frequency band. It has a minimum power output of 210 kilowatts. Similar to the 4J50 fixed-frequency tube in other characteristics, it will fit in the same socket, electrically and mechanically.

Pocket-Size Tape Recorder

Mohawk Business Machine Corporation of 944 Halsey St., Brooklyn 33, N.Y., has come up with an answer in its announcement of a new pocket-size recorder called the Midgetape. Weighing only three pounds and measuring only 8 1/2" long by 3 1/2" wide by 1 1/2" thick, it is truly portable and will fit into places that no previous device could have, either in cabin or cockpit. Midgetape has only three controls and operates on two extended, long-life batteries. Cartridge-loaded tape simplifies handling, makes recordings easy to carry or mail. It records up to one full hour of continuous transmission, which should be ample for the average radio usage on a flight of at least six hours. Tape cartridges are re-usable and can be erased automatically.

Battery life varies from 45 hours to 100 hours (for the "B" battery). Frequency response is from 200 to 5,000 cps within 5 db. Recording level is indicated by colored marks on

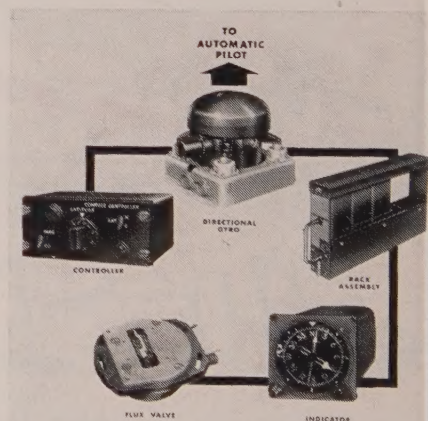
the volume control. Record playback time is the same one hour and rewind is manual.

The Midgetape is delivered with a one-hour recording cartridge, crystal microphone, earphone and batteries, and lists at \$249.50. The tape can be played back on any standard machine employing similar-type tape, and stethotype earphones or individual earpieces are available. Also an AC-DC amplifier has been designed for loudspeaker playback. Power converter is available to operate Midgetape from 110-volt AC. Telephone mikes, chronograph-style wristwatch mikes for Dick Tracy pilots and concealable lapel pin mikes and shoulder-holders for convenience suggest many interesting handy applications in the cockpit. Although Midgetape has its own leather carrying case, a fitted briefcase is available which, aside from concealing the recorder, makes the whole outfit as portable as the familiar pilot's flight case. Even 12-foot extension cords are available.

Beech Gets Republic Order For Droppable Jet Tanks

Beechcraft's main plaint at Wichita has a new job schedule up on the board: a multi-million-dollar order for jettisonable fuel tanks for Republic F84-F and RF-84F jet fighters.

The contract between Beech and Republic calls for "sizeable quantities" of the tanks, according to spokesmen for the firms, with the exact number classified.



COMPENSATING COMPASS Photo shows key components of the Sperry Gyrocompass Co.'s new G-10 Gyrosyn Compass System featuring automatic compensation for earth rate drift of the gyro. The all-transistorized, practically no-drift system was developed in response to requirements for system with less than a 3° hourly drift rate with the gyro in an unslaved state. Additional accuracy is achieved because signals from flux valve go direct to indicator, thus avoiding transmission error.